COESAM/PDFR-90/009

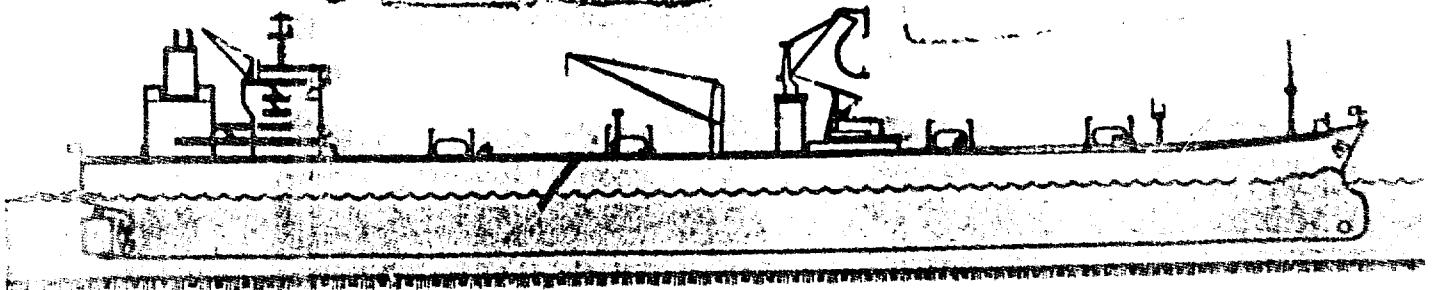
US Army Corps
of Engineers
Mobile District

GENERAL DESIGN MEMORANDUM

APPENDIX D
ENVIRONMENTAL DOCUMENTS

PASCAGOULA HARBOR CHANNEL IMPROVEMENT

PASCAGOULA, MISSISSIPPI



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GENERAL DESIGN MEMORANDUM

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PASCAGOULA, MISSISSIPPI

APPENDIX D

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Revised: Feb 1992

PASCAGOULA HORBOR, MISSISSIPPI

APPENDIX D

ENVIRONMENTAL DOCUMENTATION

Rev. Feb 1992

SECTION D-1

SECTION 404(b)(1) EVALUATION
FOR
PASCAGOULA HARBOR, MISSISSIPPI
NAVIGATION IMPROVEMENTS CONSTRUCTION DREDGING
AND FIVE YEAR MAINTENANCE DREDGING

Section 404(b)(1) Evaluation
For
Pascagoula Harbor, Mississippi
Navigation Improvements Construction Dredging
and Five Year Maintenance Dredging

Introduction. The proposed plan to provide navigation improvements at the Pascagoula Harbor Project requires the widening and deepening of the existing channel alignments from the Gulf of Mexico into Bayou Casotte and Pascagoula Harbor and the disposal of materials dredged from these channels. For ease of presentation of the Section 404(b)(1) Evaluation, the discussion of the materials to be disposed is divided into three categories:

A) materials dredged from the Pascagoula Entrance Channel;

B) reconstruction of the Grande Batture Island and subsequent oyster reef establishment; and

C) maintenance materials dredged from the channel alignments within Mississippi Sound.

A(I). **Project description.** Materials to be removed from the Pascagoula Entrance Channel would be disposed in shallow water adjacent to the eastern end of Horn Island. Approximately 3,330,000 cubic yards of new work material and a total of 34,550,000 cubic yards of maintenance material would be disposed in this area over the life of the project. See the Main Report of the General Design Memorandum for a detailed description of the recommended activity.

a. Authority and Purpose. The study of possible improvements to the Pascagoula Harbor was originally authorized by United States Senate Public Works Committee Resolutions adopted on September 23, 1965, and February 10, 1971 and House Public Works Committee Resolution adopted on June 23, 1971. These resolutions requested feasibility studies to determine if modifications to the existing navigation project at Pascagoula Harbor are warranted. In 1977, the study was postponed at the request of the Jackson County Port Authority. The study was resumed in 1984, also at the Port Authority's request. Improvements to the channel were recommended in the Mobile District Report Pascagoula Harbor, Mississippi, Feasibility Report and Final Environmental Impact Statement, Improvement of the Federal Deep-Draft Navigation Channel, dated September 1984 and amended March 1985, and the Chief of Engineers Report dated 14 February 1986. The recommended improvements were authorized in Section 201(a) of the Water Resources Development Act of 1986 (P.L. 99-662).

b. Description of the Proposed Dredged and Fill Materials from the Pascagoula Entrance Channel.

(1) General characteristics. The fill material that would be placed in the shallow subtidal sites consists of naturally occurring sand.

(2) Quantity of material proposed for discharge. Approximately 3,330,000 cubic yards of new work and a total of 34,550,000 cubic yards of maintenance material dredged from the Pascagoula Entrance Channel would be placed on the shallow subtidal sites over the 50 year life of the project.

(3) Source of materials. The dredged material would be obtained by dredging the Horn Island Pass and northern and southern transition segments of the Pascagoula Harbor project which is approximately 24,000 feet east of the proposed disposal sites.

c. Description of the Proposed Discharge Sites.

(1) Location and areal extent. The sites are located adjacent to the eastern of Horn Island within the Mississippi Sound and the Gulf of Mexico, and occupy approximately 1000 acres of shallow subtidal habitat.

(2) Type of discharge site. The placement sites are typical of the nearshore Gulf of Mexico with predominately marine sand substrate.

(3) Method of discharge. The material would be placed in the site utilizing either an hydraulic pipeline/cutterhead dredge or hopper dredge or hopper barges.

(4) When would disposal occur? Disposal is scheduled to begin in 1995. Maintenance disposal would occur annually thereafter.

(5) Projected life of discharge site. The proposed life of the placement sites is 50 years.

A(II). **Factual Determinations.**

a. Physical Substrate Determinations.

(1) Substrate elevation and slope. The placement of the dredged material may result in some mounding, however the wave climate of the region of the eastern end of Horn Island is such that this should not pose a significant impact to the resources of the island or circulation in the nearshore Gulf of Mexico or Mississippi Sound.

(2) Sediment type. Mineral composition and particle size of the substrate would not be altered.

(3) Dredged or fill material movement. The dredged material is expected to be transported in the littoral drift system of Horn Island. This movement however, would not have any adverse impact on the area and would result in nourishment of Horn Island.

(4) Physical effects on benthos. The placement of the dredged material would disrupt the benthic community of the disposal sites, however the communities of these areas should reestablish within 6 to 12 months after the placement occurs.

(5) Actions taken to minimize impacts. Since the material to be disposed is naturally occurring sand and the substrate of the placement sites is sand, no further actions are deemed necessary.

b. Water Circulation, Fluctuation and Salinity Determinations.

(1) Water. There would be no significant impacts on water chemistry, color, odor, taste, dissolved gas levels, nutrients or eutrophication characteristics due to dredging or disposal. Water clarity may be temporarily reduced during the dredging and disposal activities but should return to normal shortly after the activity is completed.

(2) Current patterns and circulation. The disposal would not result in any change in current patterns or circulation.

(3) Normal water level fluctuations. There would be no change in normal water level fluctuations.

(4) Salinity gradients. There would be no change in salinity patterns or gradients.

c. Suspended Particulate/Turbidity Determinations.

(1) Expected changes in suspended particulates and turbidity levels in vicinity of disposal site. Short-term increases in suspended particulate levels may occur at the time of dredging and disposal. However, due to the nature of the material to be disposed these increases would be within the normal range of fluctuation of these parameters for this area of Mississippi Sound and the nearshore Gulf of Mexico and would not violate state water quality standards.

(2) Effects on chemical and physical properties of the water column. Slight decreases in the degree of light penetration and dissolved oxygen concentration may occur during disposal and dredging activities.

(3) Effects on biota. Effects would be insignificant since the biota of this area are adapted to the naturally turbulent nature of the nearshore zone.

(4) Actions taken to minimize impacts. Due to the nature of the material to be disposed and the energy regime of the placement sites the impacts would be minimal. Appropriate actions would be taken, e.g. use of observers, to minimize any conflict with the use of the area by sea turtles.

d. Contaminant Determinations. The material proposed for discharge has been determined to meet the criteria set forth in 40 CFR 230.60(b) in that the material is characterized as sand which is sufficiently removed from sources of pollution to provide reasonable assurance that the material would not be contaminated by such pollution and the fact that the material itself is inert. Also the material originates in the near vicinity of the disposal activity, is similar to the substrate of the disposal sites, and

receives the same overlying waters as the disposal sites. Hence, no further physical, biological, or chemical testing is required pursuant to the 404(b)(1) Guidelines.

e. Aquatic Ecosystem and Organism Determinations.

(1) Effects on plankton. Disposal of dredged material into open water would destroy some phytoplankton and zooplankton, and could reduce light penetration which may tend to affect primary production by the phytoplankton. Due to the nature of the materials to be disposed, these impacts would not be significant.

(2) Effects on benthos. Open water disposal of the sandy material could smother some of the benthos of the proposed sites, however these organisms are adapted to a very rigorous environment in which they experience wave and storm induced sedimentation and the impacts due to the disposal would not be significant.

(3) Effects on nekton. Some nektonic species in and around the open water disposal areas would probably vacate the area, at least until conditions become more favorable. All such organisms would not be expected to vacate; however, it is logical to assume that many would avoid an area of disturbance such as that associated with discharge of dredged material. Some nektonic filter feeders may be killed as a result of being in the affected area and other organisms less capable of movement, such as larval forms, may be physically covered with dredged material. Generally, however, most organisms would avoid and later return to the project area.

(4) Effects on aquatic food web. No significant effects.

(5) Effects on special aquatic sites.

(a) Sanctuaries and refuges. The proposed disposal of dredged material would not significantly affect any of the fish and wildlife resources which are designated for preservation or general use in the 1980 Mississippi Coastal Program.

(b) Wetlands. No wetlands would be filled during the proposed activity.

(c) Mud flats. No significant effects.

(d) Vegetated shallows. Vegetated shallows exist along portions of the northern side of Horn Island. Historic placement of sand in the vicinity of 'Sand Island' has not resulted in any adverse impacts to these resources. The continuation of this practice therefore would result in no significant effects.

(e) Coral reefs. Not applicable to this area.

(f) Riffle and pool complexes. Not applicable to this area.

(6) Threatened and endangered species. The green sea turtle, Chelonia mydas, may have nested on Horn Island in the past. The loggerhead sea turtle, Caretta caretta, probably nested on Horn Island in the past and could nest there now, although there are no recent records. Kemp's ridley sea turtle, Lepidochelys kempi, is a rare visitor in the open gulf. The use of the proposed placement sites would supplement the littoral supply of sand to Horn Island and therefore stabilize the habitat utilized by these species.

(7) Other wildlife. No significant effects.

(8) Actions to minimize impact. Construction boat operators would be instructed to keep a lookout for sea turtles and should any be sighted appropriate coordination efforts with the National Marine Fisheries Service would be initiated immediately and a coordinated effort be made to avoid impacts to these species.

f. Proposed Disposal Site Determinations.

(1) Mixing zone determination. The State of Mississippi determines mixing zones on a case-by-case basis. For similar disposal activities, the State has established a mixing zone of 750 feet. Turbidity increases of 50 JTU's above background levels beyond a 750-foot mixing zone would not occur due to the nature of the material to be disposed.

(2) Determination of compliance with applicable water quality standards. This area of Mississippi Sound and the nearshore Gulf of Mexico is classified for recreational use and shellfish harvest. The placement of dredged material in either of the proposed sites would not alter constituent concentrations established for this use, and would not violate other State Water Quality Standards.

(3) Potential effects on human use characteristic. The placement of dredged material would not adversely affect any of the human use characteristics of the area. Horn Island is a part of the Gulf Islands National Seashore system and is currently undergoing erosion/deposition in a westerly direction. The disposal activity would help to reduce the rate of erosion of the eastern end of the island thereby helping to maintain the island as a national park.

g. Determination of Cumulative Effects on the Aquatic Ecosystem. Cumulative effects of the placement action would be positive in that the rate of erosion of the eastern end of Horn Island should be reduced over the life of the project. Beneficial impacts of helping maintain the position of the island include protection of mainland shores, protection of seagrass beds along the northern shore of the island, and protection of wildlife and shorebird habitat and habitat of endangered and threatened species.

h. Determination of Secondary Effects on the Aquatic Ecosystem. Secondary effects of the placement operation would be in terms of maintenance of Horn Island and its effects on the overall nearshore community. This should result in increased stability of the ecosystem which in turn would result in increased productivity.

B(I). **Project Description.**

New work dredged material from the Bayou Casotte channel and turning basin will be used in the reconstruction of the Grande Batture Islands. Approximately 5,000,000 cubic yards of dredged material will be placed within an engineered containment facility. This facility will occupy approximately 800 acres of shallow bottoms along the 1896 alignment of the eroded island. Material will be placed in the facility utilizing a hydraulic pipeline dredge. Upon consolidation, wetland vegetation will be planted on about 730 acres of the reconstructed island. In addition, oyster reefs will be constructed on approximately 2100 acres of bottoms in Pt aux Chenes Bay north of the island. Approximately 315,000 cubic yards of oyster cultch will be deposited on these bottoms over a three year period and oyster spat will be introduced into the area.

a. Authority and Purpose. This study was originally authorized by United States Senate Public Works Committee Resolutions adopted on September 23, 1965, and February 10, 1971 and House Public Works Committee Resolution adopted on June 23, 1971. These resolutions requested feasibility studies to determine if modifications to the existing navigation project at Pascagoula Harbor are warranted. In 1977, the study was postponed at the request of the Jackson County Port Authority. The study was resumed in 1984, also at the Port Authority's request. Improvements to the channel were recommended in the Mobile District Report Pascagoula Harbor, Mississippi, Feasibility Report and Final Environmental Impact Statement (FEIS), Improvement of the Federal Deep-Draft Navigation Channel, dated September 1984 and amended March 1985, and the Chief of Engineers Report dated 14 February 1986. The recommended improvements were authorized in Section 201(a) of the Water Resources Development Act of 1986 (P.L. 99-662). Although the restoration of the Grande Batture Island was not recommended at this time, an analysis of the impacts associated with this action were discussed in the FEIS. A Post Authorization Change (PAC) Report will be prepared to recommend the reconstruction of the island and subsequent reestablishment of the oyster reefs prior to the initiation of the activity.

b. Description of the Proposed Dredged and Fill Materials.

(1) General characteristics. The fill material that would be utilized during the reconstruction of the Grande Batture Island consists predominately of fat clay with small amounts of sand. Oyster cultch materials would consist of dead oyster or clam shell.

(2) Quantity of material proposed for discharge. Approximately 5,000,000 cubic yards of new work dredged material will be placed within the site. Approximately 315,000 cubic yards of oyster cultch would be utilized in the initial establishment of the oyster reefs. Subsequent maintenance of the reefs would occur on a 5-year basis, with the placement of approximately 100 cubic yards of cultch per acre. Estimates are that one-fifth of the total reef would be maintained every five years.

(3) Source of materials. The dredged material would be obtained by construction dredging of the new Bayou Casotte turning basin, widening and deepening the Bayou Casotte channel, and deepening the lower Pascagoula channel within Mississippi Sound. Oyster cultch would be obtained commercially and would originate in the Gulf of Mexico region.

c. Description of the Proposed Discharge Site.

(1) Location and areal extent. The 1896 Coast Chart (No. 189) showed Grande Batture Island as a long continuous spit extending east and west from South Rigolets Island along the Mississippi - Alabama border (Figure 404-1). This area is approximately 4 miles west of the Chevron Oil Refinery on Bayou Casotte in Pascagoula, Mississippi. The proposed reconstruction site occupies approximately 800 acres from the Mississippi state line westward, a distance of about 3 miles. The proposed oyster reefs cover approximately 2100 acres of Pt aux Chenes Bay.

(2) Type of discharge site. The Grande Batture Island restoration site is currently characterized as shallow water bottoms. A southern containment dike will be constructed utilizing Longard Tubes protected by rock armor. The northern containment dike will be constructed of hay bales. Top elevation of the southern and northern dikes will be +5-foot and +3-foot MSL, respectively. The Pt aux Chenes Bay is most shallow water bottoms. Placement of oyster cultch in this area would be unconfined.

(3) Method of discharge. Dredged material would be placed on the site using a hydraulic cutterhead/pipeline dredge. Oyster cultch would be placed on the reefal areas by blowing the cultch shell off barges with high pressure water hoses or be placed by hand by shovelling the material from small boats.

(4) When would disposal occur? Disposal is scheduled to begin in 1995. Reef creation would begin approximately two years later.

(5) Projected life of discharge site. The proposed placement will be a one time activity, however the proposed life of the reconstructed island is at least 50 years, which represents the economic life of the project. The oyster reefs which would be established will be managed to extend their life indefinitely.

B(II). **Factual Determinations.**

a. Physical Substrate Determinations.

(1) Substrate elevation and slope. The depth of the proposed reconstruction site is approximately 4 feet or less. Reconstruction of the island would raise the elevation to approximately +2 feet MSL in the wetland area and +5 feet MSL along the southern containment dike. Establishment of the oyster reefs would have minimal impact on substrate elevation and slope.

(2) Sediment type. The predominant types of material to be disposed are fat clays with some sand. Existing bottoms in the area are variable, including hard sands and muds therefore some change in the mineral composition and particle size of the disposal site substrate would occur. Oyster cultch is composed of dead oyster or clam shell. Placement of these material would substantially modify the characteristics of the upper sediment layer, i.e. the upper layer will now be composed of shell. No other changes to sediment type would occur.

(3) Dredged or fill material movement. Initially the dredged material will be placed within an engineered containment area. Subsequently, the majority of the area will be vegetated with native wetland plants. The southern dike will be maintained throughout the life of the project as needed. The northern dike will be allowed to deteriorate to provide for exchange of water and materials between the created wetland and open water areas. Some movement of dredged material off the northern face of the wetland may occur through the life of the project, however, this movement of materials should not pose a significant problem to the resources of the Pt aux Chenes Bay or Mississippi Sound. Due to the weight of oyster cultch material it is unlikely that movement of these materials would occur naturally once the restoration of the island is completed.

(4) Physical effects on benthos. The placement of the dredged material would disrupt the benthic community of the open water disposal site. With time, a new community characteristic of coastal wetlands would establish within the former discharge area. Although different, the value of this community to the ecosystem would be enhanced from that which is currently at the site. Placement of oyster cultch would have minor physical impact on the benthos. However, the benthic community which is typically associated with oyster reefs is substantially different from that of open water. This change however is not viewed negatively since the oyster reef community is typically more diverse and productive than that which is currently present.

(5) Actions taken to minimize impacts. The construction of the containment dikes, maintenance of the south containment dike, and the establishment of wetland vegetation would substantially minimize impacts to the eastern Mississippi Sound estuary. No actions are deemed necessary to minimize the impacts associated with the establishment of the oyster reefs.

b. Water Circulation, Fluctuation and Salinity Determinations.

(1) Water. Increases in dissolved and total organic carbon, dissolved ammonia, nitrate and total Kjeldahl nitrogen levels would be associated with disposal however, these increases are expected to be short-term in nature and therefore no significant impacts are expected to result from the proposed confined disposal activities. There would be no significant impacts on odor, taste, or eutrophication characteristics due to the confined disposal activities. The return water from the site would have no significant impact on water chemistry, color, odor, taste, dissol· ı gas levels, nutrients or eutrophication characteristics of the adjacent areas. There may be some increase in nutrient concentrations or decreases in dissolved oxygen but these would be rapidly dispersed due to the nature of oceanographic conditions within Mississippi Sound. Placement of oyster cultch would have no impact on water circulation, fluctuation, or salinity of the area.

(2) Current patterns and circulation. Based on results obtained from the WIFMS model during the Mississippi Sound and Adjacent Areas Study (USACE, 1984), the following conditions are typical of Mississippi Sound in the region of Pascagoula: 1) under low freshwater inflow and winds from the south/southeast currents are less than 1 foot per second (fps), except in the Horn Island Pass area. During ebb cycle, highest velocities are located in the pass with measurable velocities present in the eastern half of the study area. During flood cycle, flows enter Horn Island Pass and are deflected westward with velocities reduced from those observed during ebb periods. Flows within the channel are oriented southward out of the Sound even during flood tides; 2) under high freshwater inflow and south/southeast winds and during ebb cycles, strong flows are noted out of Pascagoula River, in the channels and in Horn Island Pass. Velocities are 1 fps or greater. During flood cycles, flows enter through Horn Island Pass and are deflected westward. Southward flows are noted out of the Pascagoula River and down the channels; and 3) under low freshwater inflow and winds from the north/northwest, ebb velocities are typically less than 1 fps and are primarily westward in nature with a southerly deflection in the region of Horn Island Pass. Flood currents are reduced in magnitude with flows entering through Horn Island Pass and being deflected eastward.

Reconstruction of the Grande Batture Island would have no impact on the circulation of Mississippi Sound. The circulation of the Pt. aux Chenes Bay would become restricted due to the protection provided by the island. As described in the following paragraphs, this restriction is believed to be highly beneficial in nature. Placement of oyster cultch would have no impact on circulation of the area.

(3) Normal water level fluctuations. There would be no change in normal water level fluctuations with the proposed action. The wave climate of the Pt. aux Chenes Bay would be substantially reduced following the completion of the reconstruction of the island. This reduction in wave energy would substantially benefit the reestablishment of oyster reefs into Pt aux Chenes Bay.

(4) Salinity gradients. Salinities in Mississippi Sound are highly variable in response to freshwater inflow and influence of the Gulf of Mexico. Based on the results of the WIFMS model, reconstruction of the island would not significantly alter salinities in the Mississippi Sound. The salinity structure of the Pt. aux Chenes Bay would be reduced following the action through the retention of freshwater inflow into the bay and the restriction of flows of higher salinity waters from the Mississippi Sound into the bay. Placement of oyster cultch would have no impact on salinity gradients in the area.

(5) Actions taken to minimize impacts. Impacts which would be associated with the reconstruction of the island and reestablishment of oyster reefs are deemed to be beneficial in nature, therefore no further actions are necessary.

c. Suspended Particulate/Turbidity Determinations.

(1) Expected changes in suspended particulates and turbidity levels in vicinity of disposal site. Localized short-term increases in suspended particulate levels may occur at the time of disposal, however these increases would be within the range of ambient turbidities for this area and would not violate state water quality standards.

(2) Effects on chemical and physical properties of the water column. Decreases in the degree of light penetration and dissolved oxygen concentration would occur during disposal activities, however these changes would be localized and short-term in nature.

(3) Effects on biota. Effects would be insignificant since the biota of this area are adapted to periodic increases of suspended material due to storm related events.

d. Contaminant Determinations. Extensive studies on pollution transport into Mississippi Sound indicate that although the load of pollutants into the Escatawpa and East Pascagoula Rivers and Bayou Casotte is high, the contaminants become trapped in the sediments and are contained in the immediate vicinity of the sources (Lytle and Lytle 1979). A district-wide sediment sampling program containing elutriate analyses was conducted in 1974 (Gulf South Research Institute 1977) which indicated that most constituents contained in the sediments are not released to the water column on disturbance. Analysis of the material in the vicinity of the proposed dredging indicated that constituents such as total organic carbon, ammonia nitrogen, total Kjeldahl nitrogen, phosphorus and lead are released into the water column. However, enough mixing occurs to dilute these constituents to acceptable concentrations. GeoScience, Inc. (1983) indicated that nitrogen compounds and total phosphorus were detected in significant quantities in sediments but only total Kjeldahl nitrogen (TKN) and ammonia were released into the water column in appreciable quantities following elutriation of sediments. Ambient levels are very close to the EPA (1976) criterion values and reflect a continuous release from the sediments as modified by tidal surges, freshwater input, winds, etc. For

ammonia, the process of elutriation, which is assumed to be comparable to the action of a dredge cutterhead, would in all cases create water column levels in excess of EPA criteria values. The increase would be rapidly diluted downward due to mixing and the tidal effects, but since ambient values are so close to criteria values, these resulting values would still exceed criteria. During the sampling of these two stations shrimp boats were continuously working the waters and the continual disturbance of the bottom was probably the cause for the increased levels of these nutrients over the other stations that were surveyed. Phosphorus showed a potentially lowered release level. Comparison of nitrogen and phosphorus reveal that nitrogen species were released much more readily during elutriation than was phosphorus and appear to show a weak relationship to the particle size and organic carbon content. Neither of these compounds are toxic at the observed levels. Ammonia may reach localized levels in excess of criteria values. Arsenic, chromium, iron, lead, nickel, and zinc occur in concentrations greater than those recorded in natural estuarine sediments. Analyses indicate that these forms are tightly bound to the sediments, predominantly montmorillinite clays. These relatively high levels of certain metals in the sediments do not appear to pose any particular hazard with respect to dredge disruption of these sediments. Preliminary data from Isphording (personal communication) indicates that as a general rule heavy metals are partitioned in the sediment predominately as organic and sulfide complexes, in residual phase, or in a moderately reducible phase. Only small percentages of the total metal concentration is found in the easily reducible phase or in the pore water/exchangeable phase. For selected metals within Mississippi Sound amounts partitioned in the easily reducible or pore water/exchangeable phase vary with metal and location within the Sound: Zinc - 7.6 to 17.8% of total; Lead - 17.8 to 24.9 %; Copper - 7.8 to 13.7%; Iron - 6.2 to 14.2%; and Nickel -1.7 to 3.6%. No identified release from sediments following elutriation or resulting concentrations well below published toxic threshold values leads to a conclusion that the activities of physically disturbing these sediments through dredge activities would have no demonstrated effect on life in the water column. data on cadmium, copper, and mercury concentrations from the project area indicate that these heavy metals present no problem within the area. A number of high molecular weight hydrocarbons were identified from the channel sediments in concentrations felt to be representative of shipping channels. These compounds were not released into the overlying water during elutriation and therefore should not have significant detrimental effects on aquatic life. Aromatic hydrocarbons have also been demonstrated to occur in the project area (Lytle and Lytle, 1983b and GeoScience, Inc., 1983). Lytle and Lytle indicate that the hydrocarbons are generally not released into the surrounding waters after sediments are resuspended, rather they remain bound to the clays, thereby reducing the effects of disposal. Lytle and Lytle (1983a) indicate that the abundance of petroleum hydrocarbons in the upper Bayou Casotte sediments compared with their relative paucity in lower bayou regions near the oil refinery source suggest that dredging of these areas has removed the contaminated sediments and thus has improved the lower bayou region.

With the exception of DDD, DDE, and PCB's, no chlorinated hydrocarbon pesticides were detected in the sediments. The levels of DDD, DDE, and PCB's are insignificantly low and reflect the ubiquitous nature and world-wide contamination observed with these compounds. None of these compounds were observed in ambient water nor were they elutriated from sediments. With the exception of certain pthalates, no base, neutral, or acid extractable organic compounds were detected in either sediments, elutriate, or water column samples. These compounds, like PCB's and certain chlorinated hydrocarbon pesticide residues, show a world wide increase coincident with increase and manufacture and subsequent disposal of wastes.

The materials to be dredged from the lower Pascagoula River, Upper Mississippi Sound, and Bayou Casotte channels were subjected to biological and chemical testing in 1987-88 to determine toxicity and bioaccumulation potential utilizing three representative marine organisms. These materials are primarily fine-grained in nature, predominately silts and clays. In addition the lower Pascagoula River and Bayou Casotte channels are in areas of extensive industrial development and maritime activities.

The toxicity of the nine sediment samples tested from the Federal navigation channel was minimal. Exposure to the sediments for 10 days had little observable adverse effect on lugworms (Arenicola cristata), oysters (Crassostrea virginica), or pink shrimp (Penaeus duorarum); survival of all three types of animals was $\geq$ 86% (Table 404-1).

Table 404-1. *Survival Rate of* Representative Marine Organisms Exposed to Channel Sediments (percent).

Channel Segment	Representative Marine Organism		
	A. cristata	C.virginica	P. duorarum
Lower Pascagoula River (3 samples)	95, 95, 93	99, 100, 99	94, 98, 100
Reference	93	100	99
Upper Mississippi Sound (3 samples)	98, 93, 92	49, 100, 100	89, 86, 96
Reference	97	100	89
Bayou Casotte (3 samples)	86, 92, 98	100, 100, 100	98, 94, 92
Reference	96	100	96

The suspended particulate phase (SPP) of the sediments had little effect on mysids (Mysidopsis bahia). Survival in 100% SPP was $\geq$ 80% for all samples.

Chemical analyses of sediments and animal tissues were performed as part of 10-day bioaccumulation studies. Residues of selected chlorinated hydrocarbon pesticides, PCB's, and chlorpyrifos were not detected in sediments or animal tissues before or after exposure to any sediments tested. However, several metals and petroleum hydrocarbons were detected in sediments and in tissues of organisms before and after exposure. Although oysters, lugworms, and shrimp exposed to Bayou Casotte sediments accumulated petroleum hydrocarbons and some heavy metals, the concentrations were not significantly greater than concentrations in animals exposed to reference sediments. Lugworms exposed to sediments from the lower Pascagoula River channel showed statistically significant differences relative to the tissue concentrations of copper, lead, and zinc. Although statistically significant differences were determined, this may not indicate bioaccumulation because of the order of magnitude of bioaccumulation that was evidenced. The greatest difference (bioaccumulation magnitude) between uptake in reference and channel sediments was less than 3X. The conclusion that this bioaccumulation magnitude does not warrant concern is based on a comparison of the uptake of single chemicals in laboratory tests under conditions of constant exposure. In such tests, commonly conducted with similar organisms and pesticides/toxic substances, bioaccumulation of chemicals in tissue $\leq$ 100X the chemical concentration in water is usually of little concern, particularly when the expected environmental concentration of the chemical is less or much less than the concentration tested in the laboratory. Potential exposure, a factor that the tests were not intended to address, is an essential factor in conducting a risk assessment. Lugworms exposed to sediments from the Upper Mississippi Sound channel showed statistically significant differences for residue concentrations of arsenic and zinc, however, this may not indicate bioaccumulation as described above (Rod Parrish, personal communication).

e. Aquatic Ecosystem and Organism Determinations.

(1) Effects on plankton. Disposal of dredged material into open water during the reconstruction of the island would destroy some phytoplankton and zooplankton, and would reduce light penetration which may tend to affect primary production by the phytoplankton. Studies conducted on the effect of maintenance dredging in a similar and nearby area, Gulfport Ship Channel, indicated that plankton are affected only in a localized area over a short period of time, and further concluded that the dredging effects on the regional and local plankton systems are negligible (Water and Air Research, 1975). Placement of oyster cultch would have no effect on plankton.

(2) Effects on benthos. Open water disposal would cover and destroy most of the benthic organisms in the affected portion of the disposal area. As discussed earlier, the benthic community which would develop in the area of the proposed reconstruction would be substantially different from that which currently characterizes the open water shallow bottoms. This change from one community type to another is not considered significant. In addition to the reconstruction of the island, approximately

2100 acres of barren bottoms within the Pt. aux Chenes Bay would be planted with oyster cultch and spat. This activity will provide a much greater diversity to the area as well as enhancing the commercial oyster industry along the northern Gulf Coast.

(3) Effects on nekton. Nektonic species utilizing the area of reconstruction would be displaced from the area. Following the construction activities and the deterioration of the hay bales used to construct the northern containment dike nektonic species would be able to utilize the wetland areas during periods of inundation. The provision of an additional 730 acres of vegetated wetlands in the area will increase the detrital input of the area and would greatly offset the loss of the shallow bottom acreage. Oyster reef communities are known to contain specialized nektonic organisms which do not habituate open bottom areas. These addition of these organisms would diversify the nektonic community of the area and provide additional trophic pathways.

(4) Effects on aquatic food web. The aquatic food web would be enhanced by the proposed placement of dredged material and oyster cultch in the reconstruction area.

(5) Effects on special aquatic sites.

(a) Sanctuaries and refuges. The proposed disposal of dredged material would result in beneficial effects on the fish and wildlife resources which are designated for preservation or general use in the 1980 Mississippi Coastal Program. The action would complement the proposed establishment of a national estuarine sanctuary in this area as well as provide protection for the Mississippi Sandhill Crane National Wildlife Refuge located north of the Grande Batture area.

(b) Wetlands. Approximately 730 acres of coastal wetlands would be established in association with the proposed activity. In addition, approximately 8 acres of existing wetlands would be protected from erosion each year of the life of the project.

(c) Mud flats. No significant effects.

(d) Vegetated shallows. None located in area.

(e) Coral reefs. Not applicable to this area.

(f) Riffle and pool complexes. Not applicable to this area.

(6) Threatened and endangered species. No threatened or endangered species would be adversely impacted by the proposed action. Reconstruction of the Grande Batture Island would provide protection to the coastal wetlands which form the southern border of a portion of the Mississippi Sandhill Crane Wildlife Refuge.

(7) Other wildlife. No significant effects. Wildlife utilizing the Pt. aux Chenes and Bangs Lakes marshes would benefit from the protection afforded by the Grande Batture Island as well as from the 730 acres of wetlands to be established in conjunction with the reconstruction.

(8) Actions to minimize impact. The proposed action is deemed beneficial to the coastal ecosystem, therefore no actions which would further reduce impacts to the aquatic ecosystem and the organisms living in that system are deemed necessary.

f. Proposed Disposal Site Determinations.

(1) Mixing zone determination. The State of Mississippi determines mixing zones on a case-by-case basis. For similar disposal activities, the State has established a mixing zone of 750 feet. Containment of the dredged material by the north and south containment dikes would minimize water quality impacts. In all cases, mixing zones would be restricted to as small an area as feasible.

(2) Determination of compliance with applicable water quality standards. State water quality classification for majority of this area of Mississippi Sound is for recreational use and shellfish harvest. A portion of Mississippi Sound to the west of the proposed action is closed to shellfish harvest. The Pt. aux Chenes Bay is approved for shellfish harvest. The disposal operation would not alter constituent concentrations established for this use and would be in compliance, to the maximum extent practicable, with all applicable water quality standards.

(3) Potential effects on human use characteristics.

(a) Municipal and private water supply. No effects.

(b) Recreational and commercial fisheries. The reconstruction of the Grande Batture Island would have significant positive impacts on recreational and commercial fisheries. The protection of existing wetlands and establishment of approximately 730 acres of wetlands would enhance the aquatic food web and provide additional spawning and nursery habitat. The establishment of 2100 acres of oyster habitat would greatly enhance the commercial oyster industry as well as providing for diversity of the habitat.

(c) Water-related recreation. Fishing and duck hunting would be enhanced by the reconstruction of the island via protection of existing resources and creation of additional resources.

(d) Aesthetics. Dredging in late fall to early winter would miss the peak recreational season however it may not be possible to schedule the disposal activities during this time due to weather and the time required to complete the activities would be longer than this period. The presence of the dredge, dredge pipe, and associated water and land based equipment would be evident and would temporarily degrade aesthetic qualities

of the area. It should be recognized, however, that the Pascagoula Harbor area is primarily an industrial area which tends to offset the aesthetic degradation caused by the action in the northern portions of the project area. Until fully vegetated, the dredged material placed within the containment area may be aesthetically unpleasing, however this would be short term in nature.

(e) Parks, national and historic monuments, national seashores, wilderness areas, research sites, and similar preserves. No significant effects.

g. Determination of Cumulative Effects on the Aquatic Ecosystem. The data and information presented suggest that the utilization of the proposed disposal site would have significant cumulative positive effects on the aquatic ecosystem.

h. Determination of Secondary Effects on the Aquatic Ecosystem. The reconstruction of the Grande Batture Island would reduce the erosion rate of the wetlands adjacent to the Pt. aux Chenes Bay. The erosion rate of this area has been calculated to be 8 to 10 acres per year. Without the proposed activity, approximately 800 to 1000 acres of wetlands would be lost during the 50 year economic life of the project. With the project in place, it has been estimated that some erosion may still occur, but at a significantly lesser rate.

C(I). Project Description.

Maintenance materials to be removed from the Pascagoula and Bayou Casotte channel alignments within Mississippi Sound will be disposed in two currently used upland disposal sites and six currently used open water disposal sites within Mississippi Sound. Approximately 300,000 cubic yards of material would be disposed in the upland areas each dredging cycle. Approximately 2,000,000 cubic yards of material would be disposed in the open water sites per dredging cycle. These sites are currently used for disposal of maintenance material from the existing Federal project. See the Main Report of the General Design Memorandum for detailed description of the recommended activity. Refer to Table 404-2 for a detailed breakdown of quantities to be dredged and disposal sites to be utilized.

a. Authority and Purpose. Authority and purpose have been described in Section A above.

b. Description of the Proposed Dredged and Fill Materials.

(1) General characteristics. The fill material that would be placed in the upland and Mississippi Sound open water disposal sites consists predominately of silt and clay with small amounts of sand.

(2) Quantity of material proposed for discharge. Refer to Table 404-2.

(3) Source of materials. The dredged material would be obtained by dredging the channel alignments within Mississippi Sound which are within approximately 1,000 - 2,000 feet of adjacent proposed disposal sites.

TABLE 404-2

CHANNEL REACH, DREDGING QUANTITY, DISPOSAL SITE MATRIX

CHANNEL REACH	DREDGING QUANTITIES		DISPOSAL SITES
Bayou Casotte Inner Harbor	NW:	None	None
	O&M:	99,000	Greenwood Island
Bayou Casotte Turning Basin	NW:	2,322,000	Grande Batture
	O&M:	incl. in Inner Harbor	
Pascagoula Inner Harbor	NW:	N/A	Gulf of Mexico
Mile 0.0 - 1.2	O&M:	250,000	Triple Barrel
Mile 1.2 - 1.8		N/A	Gulf of Mexico
Bayou Casotte Channel	NW:	3,500,000	Grande Batture
	O&M:	800,000	Open Water 3, 4
Upper Pascagoula Channel	NW:	N/A	Gulf of Mexico
Mile 1.8 - 3.0	O&M:	N/A	Gulf of Mexico
Mile 3.0 - 'Y'		680,000	Open Water 6B, 7
Lower Pascagoula Channel	NW:	N/A	Gulf of Mexico
	O&M:	400,000	Open Water 7, 8, 9
Entrance Channel	NW:	3,300,000	Open Water 10 & Horn Island Site
	O&M:	700,00	Open Water 10 & Horn Island Site

Notes: NW = New Work in cubic yards
O&M = Maintenance in cubic yards per dredging cycle

Transport of dredged material to the Gulf of Mexico for the purpose of disposal is evaluated under Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972, as amended.

c. Description of the Proposed Discharge Sites.

(1) Location and areal extent. The Double Barrel (Lowery Island) Disposal Site is a 115 acre site located on the west bank of the Pascagoula River, south of the L&N Railroad. The Greenwood Island Disposal Site is a 101 acre site located on the west side of the mouth of Bayou Casotte. Open water disposal sites 3 and 4 are located on the east side of the Bayou Casotte channel, sites 6S (6B), 7, 8, and 9 are located on the west side of the Upper and Lower Pascagoula channels. The set back is approximately 1,000 feet from the channel with the exception of site 6S (6B) which is set back approximately 2,000 feet from the channel. The area of Mississippi Sound bottoms designated as open water disposal sites for the project occupy about 4,200 acres of which approximately 1,860 acres would be utilized for each maintenance cycle depending upon dredging needs.

(2) Type of discharge site. Lowery Island and Greenwood Island are diked, extensively managed upland disposal sites. Sites 3, 4, 6S (6B), 7, 8, and 9 are currently used open water disposal sites and are typical of eastern Mississippi Sound with substrates composed predominately of silt and clay with varying percentage of sand. These sites were the subject of an EA/FONSI prepared 6 December 1984 and 404(b)(1) Evaluation prepared 18 October 1984 for recertification of the existing Federal project. Continuation of these activities was the subject of a Mississippi Bureau of Pollution Control / U.S. Army Corps of Engineers Joint Public Notice (P.N. No. FP-89-PA-05-4) Issued on 29 September 1989. Water Quality Certification was received from the State of Mississippi on 2 October 1989 and is in effect until October 1994.

(3) Method of discharge. The material would be placed on the sites using a hydraulic cutterhead/pipeline dredge.

(4) When would disposal occur? Disposal is scheduled to begin in 1997 and would occur on an annual basis thereafter.

(5) Projected life of discharge site. The proposed life of the disposal sites is 50 years.

C(II). **Factual Determinations.**

a. Physical Substrate Determinations.

(1) Substrate elevation and slope. Bathymetry recorded in 1979 and 1982 indicated that adequate depths exist to support the disposal of dredged material for the proposed 50-year project life. Based on this bathymetry, depths at each open water site to be utilized are as follows: Site 3--5.5 feet to 11.0 feet (1979 data); Site 4--5.5 feet to 13.0 feet (1979 data); Site 6B--6.0 feet to 11.0 feet (1982 data); Sites 7, 8, and 9--5.5 feet to 16.5 feet (1982 data). Due to the silty nature of the material to be disposed and the natural oceanographic conditions of eastern Mississippi Sound, no significant buildup should be experienced. Should significant buildup of dredged material occur in these open water disposal

areas, a re-evaluation of the disposal practice utilized would be conducted. It should be noted that the State of Mississippi Bureau of Marine Resources prohibits disposal in open water less than 4 feet in depth. The Corps of Engineers intends to meet this requirement throughout the life of the proposed project. The upland disposal area dikes would reach elevations of 40 feet for the 50-year project life. Present dike elevations at Lowery Island are about 16 feet, Singing River Island about 24 feet, and Greenwood Island about 18 to 19 feet.

(2) Sediment type. The predominant types of material to be disposed are silts and clays with some sand therefore the mineral composition and particle size of the disposal site substrate would not be altered.

(3) Dredged or fill material movement. The dredged material, when placed into the open water disposal areas, will be subject to mud flows. The disposal sites are of such size that these mud flows should not impact adjacent areas not previously impacted by deposition of comparable material. Since these areas are currently utilized for disposal of similar materials from the existing Federal project and projected quantities for the proposed plan are only on the order of 5% greater than those currently disposed, this movement of materials should not pose a significant problem. Upland disposal would be confined to the limits of the diked areas. The residence time of the return water within the disposal sites would be such that no impacts would result from movement of materials.

(4) Physical effects on benthos. The disposal of the dredged material would disrupt the benthic community of the open water disposal sites during placement, however the community should reestablish within 6 to 12 months after the disposal occurs. The return from the upland disposal sites would have no impacts on the benthos.

(5) Actions taken to minimize impacts. The materials to be disposed are similar in granulometry to those that exist at the proposed disposal sites, therefore no further actions are deemed necessary.

b. Water Circulation, Fluctuation and Salinity Determinations.

(1) Water. Increases in dissolved and total organic carbon, dissolved ammonia, nitrate and total Kjeldahl nitrogen levels would be associated with disposal however, these increases are expected to be short-term in nature and therefore no significant impacts are expected to result from the proposed open water disposal activities. Ambient conditions in the Pascagoula Harbor/Bayou Casotte/Mississippi Sound area are turbid; however, it is recognized that during open water disposal of dredged material that turbidity plumes and mud flows occur, both of which tend to reduce water clarity. This condition will prevail during the disposal operations but would not affect a large portion of the Sound. Color would be affected during disposal with the water appearing darker due to the presence of a "plume" from the discharge of silty material. This would be a temporary condition which would cease shortly after disposal ceases. There would be

no significant impacts on odor, taste, or eutrophication characteristics due to the open water disposal activities. The return water from the upland disposal areas would have no significant impact on water chemistry, color, odor, taste, dissolved gas levels, nutrients or eutrophication characteristics of the adjacent areas. There may be some increase in nutrient concentrations or decreases in dissolved oxygen but these would be rapidly dispersed due to the nature of oceanographic conditions within Mississippi Sound.

(2) Current patterns and circulation. The typical oceanographic conditions of the project area have been described in Section B above. This study also projected what conditions would have been prior to the provision of a navigation channel system. Under low freshwater inflow and winds from the south/southeast, ebb current velocities were low, about 0.2 fps, in most of the Sound, with somewhat higher velocities in Horn Island Pass and south of Petit Bois Island. During flood cycles, current velocities appear to be very low, on the order of 0.2 to 0.4 fps with highest velocities in the pass. Flows appear to be deflected westward on incoming tides. Under high freshwater inflow and winds from south/southeast, "preproject" currents during ebb cycles were primarily to the south, approaching 1 fps in the area of the river and island pass. During flood cycles, flows probably entered the south through the island pass and were deflected westward with velocities less than 1 fps. Under conditions of low freshwater inflow and north/northeast winds ebb flows were oriented to the east, turning southeast and south through the tidal pass at less than 1 fps. Flood cycles produced flows in an eastward direction at velocities of 0.2 fps or less. Thus, "preproject" and existing conditions appear to be much the same. Therefore, the use of open water disposal in Mississippi Sound should not result in any change in current patterns or circulation. Disposal into the upland disposal sites and subsequent return flows would have no effect on current patterns and circulation.

(3) Normal water level fluctuations. There would be no change in normal water level fluctuations with either open water or upland disposal.

(4) Salinity gradients. Salinities in Mississippi Sound are highly variable in response to freshwater inflow and influence of the Gulf of Mexico. Based on the results of the WIFMS model, use of the proposed disposal areas in Mississippi Sound would not significantly alter salinities in the area. Salinity changes would be localized and less than + 2 ppt. The return water from the upland disposal areas would have no impact on salinity.

(5) Actions taken to minimize impacts. Based on the results of the model studies on Pascagoula Harbor and analysis of historic bathymetric data, it appears that the use of the proposed disposal sites for the maintenance materials from the proposed navigation improvements would not cause significant circulation problems in the project area. The minus 4-foot MLW restrictions by the State of Mississippi would be observed during disposal operations.

c. Suspended Particulate/Turbidity Determinations.

(1) Expected changes in suspended particulates and turbidity levels in vicinity of disposal sites. Localized short-term increases in suspended particulate levels may occur at the time of disposal, however these increases would be within the range of ambient turbidities for this area and would not violate state water quality standards.

(2) Effects on chemical and physical properties of the water column. Decreases in the degree of light penetration and dissolved oxygen concentration would occur during disposal activities, however these changes would be localized and short-term in nature.

(3) Effects on biota. Effects would be insignificant since the biota of this area are adapted to periodic increases of suspended material due to storm related events and annual high freshwater inflows.

d. Contaminant Determinations. The extent of contamination of the sediments of the Pascagoula Harbor project have been discussed in detail in Section B above.

e. Aquatic Ecosystem and Organism Determinations.

(1) Effects on plankton. Disposal of dredged material into open water would destroy some phytoplankton and zooplankton, and would reduce light penetration which may tend to affect primary production by the phytoplankton. Studies conducted on the effect of maintenance dredging in a similar and nearby area, Gulfport Ship Channel, indicated that plankton are affected only in a localized area over a short period of time, and further concluded that the dredging effects on the regional and local plankton systems are negligible (Water and Air Research, 1975). Return water from the upland disposal areas would have no impact on plankton.

(2) Effects on benthos. Open water disposal would cover and destroy most of the benthic organisms in the affected portion of the disposal area. In addition, the possibility exists that mud flows would disrupt additional organisms outside the limits of the disposal area. The extent to which this may be expected to occur is not considered significant. Benthic communities would re-establish within 6 to 12 months after disposal through immigration from outlying areas and through the settling of the planktonic larvae which characterize most benthic species. The benthic communities which characterize the Mississippi Sound area are adapted to highly variable oceanographic conditions and are able to respond to natural perturbations such as sedimentation and storm induced sediment disturbance (Vittor, 1983). In addition the Gulfport study indicated that benthic community changes appear to be dominated by natural variations and seasonal changes rather than by dredging and disposal activities. Return water from the upland disposal sites would have no impact on the benthos.

(3) Effects on nekton. Some nekters in and around the open water disposal areas would probably vacate the area, at least until conditions become more favorable. All such organisms would not be expected to vacate; however, it is logical to assume that many would avoid an area of disturbance such as that associated with discharge of dredged material. Some nektonic filter feeders may be killed as a result of being in the affected area and other organisms less capable of movement such as larval forms may physically covered with dredged material. Generally, however, most organisms would avoid and later return to the project area. Return water from the upland disposal sites would have no impact on the nekton.

(4) Effects on aquatic food web. No significant effects.

(5) Effects on special aquatic sites.

(a) Sanctuaries and refuges. The proposed disposal of dredged material would not significantly affect any of the fish and wildlife resources which are designated for preservation or general use in the 1980 Mississippi Coastal Program.

(b) Wetlands. No wetlands would be filled during the proposed activity.

(c) Mud flats. No significant effects.

(d) Vegetated shallows. No significant effects.

(e) Coral reefs. Not applicable to this area.

(f) Riffle and pool complexes. Not applicable to this area.

(6) Threatened and endangered species. No threatened or endangered species would be impacted by the proposed action.

(7) Other wildlife. No significant effects.

(8) Actions to minimize impact. No actions which would further reduce impacts to the aquatic ecosystem and the organisms living in that system are deemed necessary.

f. Proposed Disposal Site Determinations.

(1) Mixing zone determination. The State of Mississippi determines mixing zones on a case-by-case basis. For similar disposal activities, the State has established a mixing zone of 750 feet. In all cases, mixing zones would be restricted to as small an area as feasible. Based on previous dredging / disposal actions at Pascagoula Harbor, it is felt that any reasonable mixing zone requirements established by the State would be met.

(2) Determination of compliance with applicable water quality standards. State water quality classification for this area of Mississippi Sound is for recreational use, closed to shellfish harvest. The disposal operation would not alter constituent concentrations established for this use and would be in compliance, to the maximum extent practicable, with all applicable water quality standards.

(3) Potential effects on human use characteristics.

(a) Municipal and private water supply. No significant effects.

(b) Recreational and commercial fisheries. Some impacts to fish and wildlife resources could occur depending upon timing of dredged material placement in open water, however these are not considered to be significant.

(c) Water-related recreation. No significant effects.

(d) Aesthetics. Dredging in late fall to early winter would miss the peak recreational season however it may not be possible to schedule the disposal activities during this time due to weather and the time required to complete the activities would be longer than this period. The presence of the dredge, dredge pipe, and associated water and land based equipment would be evident and would temporarily degrade aesthetic qualities of the area. It should be recognized, however, that the Pascagoula Harbor area is primarily an industrial area which tends to offset the aesthetic degradation caused by the action in the northern portions of the project area.

(e) Parks, national and historic monuments, national seashores, wilderness areas, research sites, and similar preserves. No significant effects.

g. Determination of Cumulative Effects on the Aquatic Ecosystem. The data and information presented suggest that the utilization of the proposed disposal sites would have no significant cumulative adverse effects on the aquatic ecosystem. Should excessive or rapid shoaling of the open water sites occur during the 50-year project life, modifications in disposal practices or disposal site use would be addressed.

h. Determination of Secondary Effects on the Aquatic Ecosystem. The impacts associated with the disposal of sandy materials in the shallow subtidal region of Horn Island which are addressed in this Sec. 404(b)(1) evaluation would act to maintain the structure of Horn Island and thereby positively impact the aquatic ecosystem of the nearshore Gulf of Mexico and this area of Mississippi Sound.

III. **Findings of Compliance or Non-Compliance with the Restrictions on Discharge.**

a. No significant adaptations of the guidelines were made relative to this evaluation.

b. A number of alternatives were considered during the planning process including:

(1) No action;
(2) Disposal of all new work in the Gulf of Mexico and;
(3) Use ocean dumping for all maintenance material with the exception of the material from the inner harbor areas.

c. The planned disposal of dredged materials would not violate any applicable State water quality standards.

d. The disposal operation would not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

e. As required by the Coastal Zone Management Act, the proposed action is consistent with the Mississippi Coastal Program (MCP) to the maximum extent practicable.

f. Use of the selected disposal site would not harm any endangered species or their critical habitat. The US Fish and Wildlife Service and the National Marine Fisheries Service concurred with this finding on December 21, 1983 and August 15, 1984, and June 25, 1984, respectively.

g. The disposal operation would not violate the Specified Protection Measures for Marine Sanctuaries Designated by the Marine Protection, Research, and Sanctuaries Act of 1972.

h. The proposed disposal of fill materials would not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life states of aquatic life and other wildlife would not be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity and stability, and recreational, aesthetic and economic values would not occur.

i. Appropriate steps to minimize potential adverse impacts of the discharge on aquatic systems have been included in this evaluation.

j. On the basis of the guidelines, the proposed sites for the discharge of fill materials are specified as complying with the requirements of these guidelines with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects to the aquatic ecosystem.

DATE:

MICHAEL F. THUSS
Colonel, CE
District Engineer

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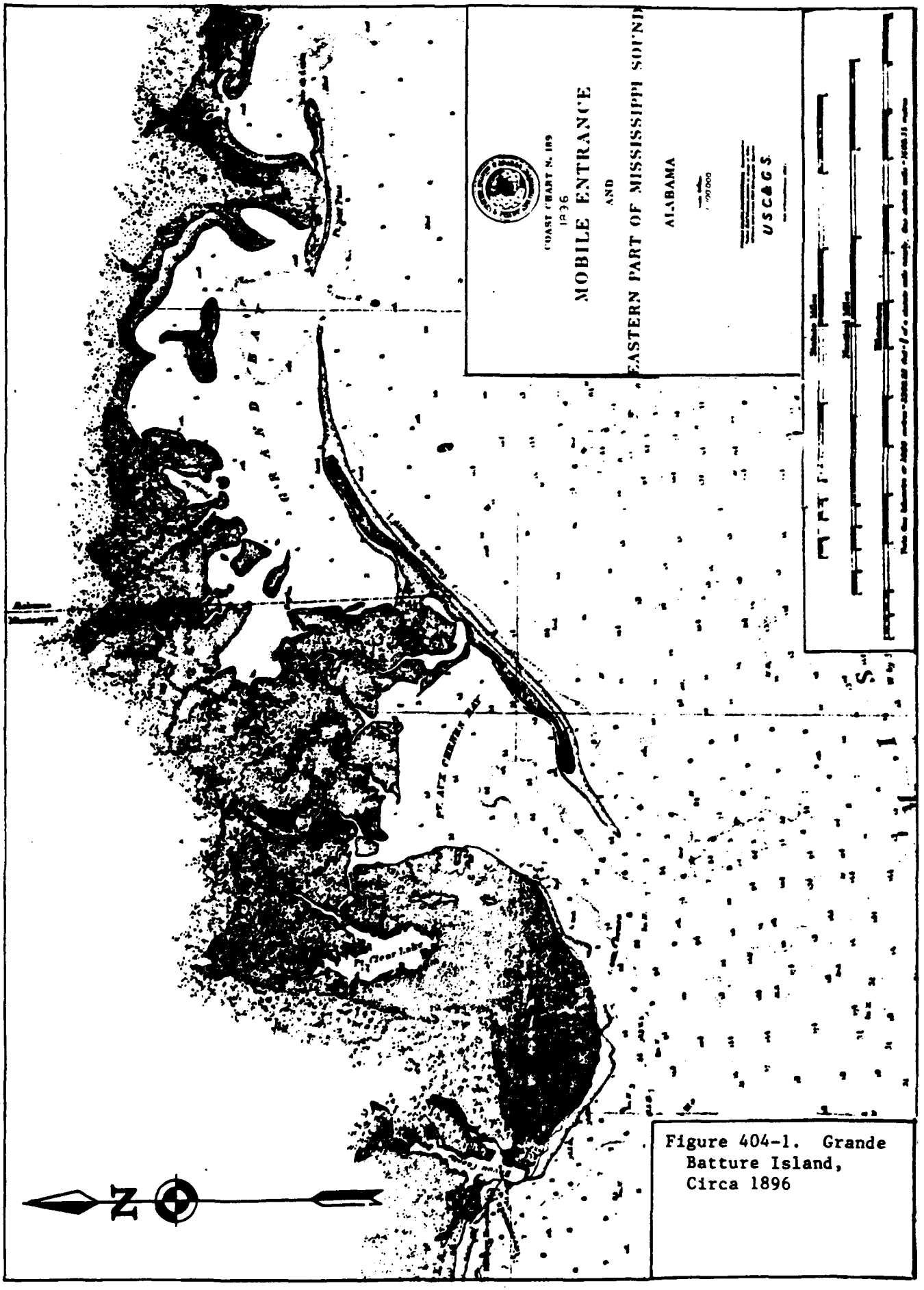

Figure 404-1. Grande Batture Island, Circa 1896

SECTION D-2

OCEAN DISPOSAL EVALUATION REPORT FOR PASCAGOULA HARBOR, MISSISSIPPI NAVIGATION IMPROVEMENTS CONSTRUCTION DREDGING AND FIVE YEAR MAINTENANCE DREDGING

Section 103
Ocean Disposal Evaluation Report
for
Pascagoula Harbor, Mississippi
Navigation Improvements Construction Dredging
and Five Year Maintenance Dredging

I. **Description of Proposed Action.** The proposed action concerns use of the Environmental Protection Agency Section 102 Ocean Dredged Material Disposal Site (ODMDS) south of Pascagoula, Mississippi. A Draft Environmental Impact Statement (EIS) for the Designation of an Ocean Dredged Material Disposal Site (ODMDS) Located Offshore Pascagoula, Mississippi, was coordinated in July 1990. The Final EIS will be filed in November 1990. This action is a coordinated effort between the U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, and U.S. Navy and reflects the action proposed in this evaluation. Improvements to the Pascagoula Harbor Channel were recommended in the Mobile District Report Pascagoula Harbor, Mississippi, Feasibility Report and Final Environmental Impacct Statement, Improvement of the Federal Deep-Draft Navigation Channel, dated September 1984, and amended March 1985, and the Chief of Engineers Report dated 14 February 1986. The recommended improvements were authorized in Section 201(a) of the Water Resources Development Act of 1986 (P.L. 99-662). New work dredged material from the authorized improvements in Pascagoula River, Upper and Lower Mississippi Sound channels, Bayou Casotte channel and turning basin, and the Gulf Entrance channel would be placed in the site. Between 6,000,000 and 11,000,000 cubic yards of clay and sand would be placed in the site over a 3 year period. The variation in quantity is due to a proposed restoration of the Grande Batture Island east of Pascagoula, Mississippi. Should this restoration be accomplished, approximately 5,000,000 cubic yards of new work material would be utilized and would, therefore, not be transported to the Gulf of Mexico for disposal. As in past maintenance operations approximately 300,000 cubic yards of sandy material to be dredged from the Gulf entrance channel would be placed in the ODMDS annually using a hopper dredge. Maintenance of the Lower Pascagoula River and Upper Mississippi Sound channels would result in between 500,000 to 1,000,000 cubic yards of fine-grained material being placed in the site via hopper dredge or dump scows on an 18-month dredging cycle. Additional maintenance material from other portions of the project may be transported to the site as described in the ODMDS EIS, however, quantities are not know at this time. New work disposal is scheduled to begin in 1995.

II. **Description of the Disposal Area.** The proposed site is located south of Horn Island along the western edge of the southernmost extent of the ship channel leading into the Pascagoula Harbor. The northern boundary site is approximately two miles south of Horn Island and two miles southwest of Petit Bois Island. The City of Pascagoula, Mississippi is located approximately nine miles due north of the site. The boundaries of the site are defined by the following coordinates:

30° 12' 06" N	88° 44' 30" W
30° 11' 42" N	88° 33' 24" W
30° 08' 30" N	88° 37' 00" W
30° 08' 18" N	88° 41' 54" W

This area represents approximately 18.5 nmi^2. Bathymetric surveys of the area indicate that the water depth within the site ranges from 39 to 53 feet with a general deepening seaward. The shallower areas are located along the northern boundary and the eastern edge of the site bordering the ship channel.

This site and its use for the Federal navigation project was evaluated and selected with full cognizance of the site selection criteria set forth in 40 CFR 228.5 and 228.6. The site is large enough and deep enough so that potential impacts outside the site will be minimized. The asite is also large enough such that appropriate management teechniques can be applied to the disposal of dredged mateerial. A conceptual management plan is provided as Appendix A to this Section 103 Evaluation. The site is within an economically transportable distance, yet is sufficiently removed from amenities such as beaches, fish havens, artificial reefs, and hard bottom areas so that these resources will not be impacted. The location of the site is amenable to surrveillance and monitoring utilizing standard equipment.

A portion of the site has been used historically for the receipt of maintenance material dredged from the channels of the Federal navigation project at Pascagoula and for projects permitted through the Department of the Army Regulatory Process. This site is a former interim EPA-approved site which was the subject of a draft supplement to the Final EIS for the Designation of the Pensacola, FL, Mobile, AL, and Gulfport, MS, ODMDSs which was prepared in 1986 and coordinated with appropriate Federal, state, and local agencies and interested public.

III. **Description of Dredged Material.** The material to be placed into the site consists of routine maintenance material dredged from the Federal navigation project. Approximately 500,000 to 1,000,000 cubic yards of predominately fine-grained material dredged from the lower Pascagoula River and Upper Mississippi Sound channels and approximately 300,000 cubic yards of predominately sand-sized materials dredged from the entrance channel from the Gulf of Mexico through Horn Island Pass will be discharged at the site each dredging event.

IV. **Environmental Testing Results.** The materials dredged from the entrance channel meets the exclusion criteria specified in 40 CFR 227.13 b(1), i.e."... dredged material composed predominantly of sand, gravel, rock, or any other naturally occurring bottom material with particle sizes larger than silt, and the material is found in areas of high current or wave energy such as streams with large bed loads or coastal areas with shifting bars and channels ...", therefore no testing of the material was performed.

The materials to be dredged from the lower Pascagoula River, Upper Mississippi Sound, and Bayou Casotte channels were subjected to biological and chemical testing in 1987-88 to determine toxicity and bioaccumulation potential utilizing three representative marine organisms. These materials are primarily fine-grained in nature, predominately silts and clays. In addition the lower Pascagoula River and Bayou Casotte channels are in areas of extensive industrial development and maritime activities.

The toxicity of the nine sediment samples tested from the Federal navigation channel was minimal. Exposure to the sediments for 10 days had little observable adverse effect on lugworms (Arenicola cristata), oysters (Crassostrea virginica), or pink shrimp (Penaeus duorarum); survival of all three types of animals was ≥ 86% (Table 103-1).

The suspended particulate phase (SPP) of the sediments had little effect on mysids (Mysidopsis bahia). Survival in 100% SPP was ≥ 80% for all samples.

Chemical analyses of sediments and animal tissues were performed as part of 10-day bioaccumulation studies. Residues of selected chlorinated hydrocarbon pesticides, PCB's, and chlorpyrifos were not detected in sediments or animal tissues before or after exposure to any sediments tested. However, several metals and petroleum hydrocarbons were detected in sediments and in tissues of organisms before and after exposure. Although oysters, lugworms, and shrimp exposed to Bayou Casotte sediments accumulated petroleum hydrocarbons and some heavy metals, the concentrations were not significantly greater than concentrations in animals exposed to reference sediments. Lugworms exposed to sediments from the lower Pascagoula River channel showed statistically significant differences relative to the tissue concentrations of copper, lead, and zinc.

Table 103-1. Survival Rate of Representative Marine Organisms Exposed to Channel Sediments (percent).

Channel Segment	Representative Marine Organism		
	A. cristata	C.virginica	P. duorarum
Lower Pascagoula River (3 samples)	95, 95, 93	99, 100, 99	94, 98, 100
Reference	93	100	99
Upper Mississippi Sound (3 samples)	98, 93, 92	49, 100, 100	89, 86, 96
Reference	97	100	89
Bayou Casotte (3 samples)	86, 92, 98	100, 100, 100	98, 94, 92
Reference	96	100	96

Although statistically significant differences were determined, this may not indicate bioaccumulation because of the order of magnitude of bioaccumulation that was evidenced. The greatest difference (bioaccumulation magnitude) between uptake in reference and channel sediments was less than 3X. The conclusion that this bioaccumulation magnitude does not warrant concern is based on a comparison of the uptake of single chemicals in laboratory tests under conditions of constant exposure. In such tests, commonly conducted with similar organisms and pesticides/toxic substances, bioaccumulation of chemicals in tissue ≤ 100X the chemical concentration in water is usually of

little concern, particularly when the expected environmental concentration of the chemical is less or much less than the concentration tested in the laboratory. Potential exposure, a factor that the tests were not intended to address, is an essential factor in conducting a risk assessment. Lugworms exposed to sediments from the Upper Mississippi Sound channel showed statistically significant differences for residue concentrations of arsenic and zinc, however, this may not indicate bioaccumulation as described above (Rod Parrish, personal communication).

V. **Need for Ocean Disposal.** The need for ocean disposal of the new work material to be dredged during the construction of improvements to the Pascagoula Harbor navigation project was established in the FEIS concerning these improvements described in Section I above. This need is based on the quantity and type of material and the lack of feasible alternatives to ocean disposal.

Should the reconstruction of the Grande Batture Island prove economically and fiscally possible, the quantity of new work material to be disposed in the ODMDS will be reduced by approximately 5,000,000 yards.

The Pascagoula Harbor navigation project has historically been maintained utilizing a number of types of disposal areas including: uplands, open water within Mississippi Sound and an interim EPA-approved ocean dredged material disposal site (ODMDS). Materials dredged from the lower Pascagoula River channel and the upper Mississippi Sound channel to approximately mile 3 was placed in the Triple Barrel and Singing River Island disposal areas, respectively. Material dredged from the inner portion of the Bayou Casotte channel was placed in the Greenwood Island disposal area. Material dredged from the entrance channel through the Gulf and Horn Island Pass was disposed in the interim EPA-approved ODMDS. The remainder of the channels in Mississippi Sound are maintained utilizing open water disposal sites. In 1985, the Port of Pascagoula Special Management Area (SMA) Plan was prepared under the auspices of the Mississippi Bureau of Marine Resources. This plan, which is an element of the Mississippi Coastal Management Plan, included a development plan, a mitigation plan, and a long-term plan for the disposal of dredged material from the upper harbor area. Also in 1985, the U.S. Navy announced the establishment of a naval station at Pascagoula as part of the Gulf Coast Strategic Homeporting project. The location of the station, the northern portion of Singing River Island, included approximately 115 acres of the upland disposal area. To facilitate Navy development of Naval Station Pascagoula, the Corps of Engineers (CE) agreed to relinquish the use of the disposal area after the 1987 dredging cycle. Material from the upper Pascagoula Channel segment, which had historically been placed in the Singing River Island disposal area, would be transported to the Gulf of Mexico for disposal in accordance with all applicable Federal laws and regulations unless a less costly, environmentally acceptable alternative could be developed.

VI. **Environmental Impacts of the Proposed Action.** The impacts associated with the use of the Pascagoula ODMDS are presented in detail in the site designation EIS referenced in Section I above. This information is incorporated into this Section 103 evaluation by reference and will not be repeated in detail. In summary the impacts associated with the proposed action are:

a. Esthetics. Short term increases in turbidity will be associated with the disposal of fine-grained material in Gulf waters. These impacts are not considered significant due to the distance of the ODMDS from recreation resources and the highly variable natural turbidity of the area.

b. Recreation Resources. Due to the distance from beaches or other recreational resources, the proposed use of the ODMDS will not result in unacceptable impacts.

c. Commercial Marine Resources. The Pascagoula ocean dredged material disposal site lies within a productive fishing region and is utilized for spawning, feeding, and breeding by migrating finfish and shellfish. However, the site represents only a small portion of the nearshore fishing grounds in the northern Gulf of Mexico. Use of a similar site south of Dauphin Island, AL during the construction of improvements to the Mobile Harbor navigation project have not resulted in adverse impacts to commercial marine resources. The proposed use of the site should have a negligible impact on commercial resources.

d. Navigation. The Pascagoula site lies outside the designated navigation channels and safety fairways, therefore no impact to commercial or defense navigation would occur. The proposed management of the dredged material at the ODMDS may result in the creation of a submerged berm. If this is accomplished the height of the berm would be restricted so as to not impact navigation of the area by commercial fishery vessels.

e. Mineral Resources. No impact. Active lease areas in the Gulf of Mexico are located south of the proposed area. Placement of dredged material in the ODMDS would not impact the hydrocarbon transportation pipelines which transect the site.

f. Water Quality. Short-term and localized impacts to turbidity, dissolved oxygen, and biological oxygen demand are expected to occur during the disposal activities. Circulation patterns within the Gulf and resulting dispersion will
significantly minimize these impacts.

g. Historical and Archeological Resources. No impact.

h. Endangered Species. Although a number of whales and sea turtles move through the vicinity of the proposed site, the disposal of dredged material would have no impact on their use of the area.

VII. **Determinations and Findings.**

I have reviewed the project files, the 1985 project FEIS, the 1990 ODMDS DEIS and the Ocean Disposal Evaluation Report. The proposed ocean disposal will present:

(a) No unacceptable adverse effects on human health and no significant damage to the resources of the marine environment;

(b) No unacceptable adverse effect on the marine ecosystem;

(c) No unacceptable adverse persistent or permanent effects to the dumping of the particular volumes or concentrations of these materials; and

(d) No unacceptable adverse effect on the ocean for other uses as a result of direct environmental impact.

DATE:

MICHAEL F. THUSS
Colonel, Corps of Engineers
District Engineer

APPENDIX A

PASCAGOULA ODMDS

SITE

MANAGEMENT AND MONITORING PLAN

PASCAGOULA ODMDS

SITE MANAGEMENT AND MONITORING PLAN

1.0 Introduction. It is the responsibility of EPA under MPRSA to manage and monitor each of the designated ODMDSs. As part of this responsibility, a management and monitoring plan has been developed to specifically address the deposition of dredged material into the Pascagoula ODMDS. The management and monitoring of the Pascagoula ODMDS will be a joint responsibility between the Corps of Engineers and the EPA.

2.0 Site Management. Section 228.3 of the Ocean Dumping Regulations (40 CFR 220-229) states that "management of a site consists of regulating times, rates, and methods of disposal and quantities and types of materials disposed of; developing and maintaining effective ambient monitoring programs for the site; conducting disposal site evaluation studies; and recommending modifications in site use and/or designation". The plan may be modified if it is determined that such changes are warranted as a result of information obtained through the monitoring process.

It is intended that the Pascagoula ODMDS will be utilized for new work and maintenance material from the Pascagoula Harbor Federal navigation project, for new work and maintenance material from the channels and turning basin associated with Naval Station Pascagoula, and by private entities such as the Port of Pascagoula, Ingalls Shipbuilding, and Chevron Refinery. Much of this use is projected to occur in the future and therefore the exact nature and quantity of the material, the time of disposal, and the type of equipment to be used are unknown.

2.1 Management Objectives. There are three primary objectives in the management of the Pascagoula ODMDS:

- o protection of the marine environment;
- o beneficial use of dredge material; and
- o documentation of the disposal activities at the ODMDS.

The following sections provide the framework for meeting these objectives.

2.2 Dredged Material Volumes. In 1985, the Port of Pascagoula Special Management (SMA) Plan was prepared to implement a strategy for the management of the port. Included in this plan was a long-term plan for the disposal of dredged material from the maintenance of the Federal project and Port facilities. In 1986, the plan was modified to include the need for ocean disposal of approximately 650,000 cubic yards of maintenance material. The modification was made necessary due to construction of Naval Station Pascagoula at an area previously used for disposal of dredged material.

Also in 1985, the Mobile District Corps of Engineers completed studies on the improvement of the Federal Deep-Draft Navigation Channel at Pascagoula. These

studies recommended improvements which would result in approximately 14 million cubic yards of construction dredged material being transported to the Gulf for disposal. These improvements were authorized by the Water Resources Development Act of 1986.

In addition, the construction of the access channel and turning basin at Naval Station Pascagoula will require the dredging of approximately 1 million cubic yards of material with subsequent maintenance of approximately 250,000 cubic yards. Initially, this material was to be placed in the remaining disposal area on Singing River Island, the location of the station. Due to the size and condition of this area, the materials from the Navy channels are currently being proposed for placement in the ODMDS. The CE anticipates that the new ODMDS will be a possible alternative for other dredging projects in the vicinity, provided that the material meets the criteria as specified in MPRSA.

A small portion of the ODMDS has historically been utilized for placement of dredged material. Estimated volumes of dredged material for the period 1990-95 are also shown (maintenance material = O&M; new work = NW).

Table G-1. Dredge material placement at the Pascagoula ODMDS.

Year	Volume	Material Type	Project
1985	300,000	O&M: Sand	Civil Works Channel
1986	65,000	NW: Sandy Mud	Point Cadet Marina
	300,000	O&M: Sand	Civil Works Channel
1987	300,000	O&M: Sand	Civil Works Channel
	100,000	O&M: Silt/Clay	Civil Works Channel
1988	300,000	O&M: Sand	Civil Works Channel
1989	500,000	O&M: Silt/Clay	Civil Works Channel
	300,000	O&M: Sand	Civil Works Channel
1990	70,000	O&M: Mixture	Civil Works Channel
	300,000	O&M: Sand	Civil Works Channel
	*		
1991	1,000,000	NW: Mixture	Navy Channels
	700,000	O&M: Mixture	Civil Works Channel
	300,000	O&M: Sand	Civil Works Channel
	100,000	O&M: Silt/Clay	Port of Pascagoula
1992	300,000	O&M: Sand	Civil Works Channel
1993	250,000	O&M: Silt/Clay	Navy Channels
	11,000,000**	NW: Mixture	Civil Works Channel
1994	***		
1995	250,000	O&M: Silt/Clay	Navy Channels

Notes:

* Disposal of O&M dredged material from Ingalls Shipbuilding may be required during 1990/91.

** Construction estimated to take 2 years therefore no O&M from the Civil Works Channel estimated for 1994/95 although some O&M may occur.

*** Disposal of new work material from the Port of Pascagoula facilities may be required during this time frame.

No restriction on material volumes are necessary for this site.

2.3 Material Suitability. Two basic sources of material are expected to be placed at the site, i.e. construction or new work dredged material and maintenance dredged material. These sediments will consist of mixtures of silts, clays, sands, in varying percentages.

There is no general restriction regarding the type of material that may be placed at the site. However, the suitability of the dredged material for disposal in the ocean will be evaluated by the CE and concurred with by EPA prior to disposal. Evaluation will involve: 1) a case-specific evaluation against the exclusion criteria (40 CFR 227.13(b); 2) a determination of the necessity for bioassay and bioaccumulation testing for non-excluded material based on the potential for contamination of the sediment since last tested; and when needed 3) completion of testing and determination of suitability of material for ocean disposal. Only those materials determined to be suitable for ocean disposal through this process will be considered for unrestricted placement at the ODMDS. Additional evaluation of management options will be required for any materials which do not meet the suitability criteria.

Baseline sediment and/or bioassay/bioaccumulation testing will be performed on all sediments proposed for ocean disposal for the first time or on new work dredged sediments unless it can be shown that those sediments meet the exclusion criteria as described above. CESAM will coordinate with EPA, Region IV prior to implementing the baseline evaluation program. Testing and evaluation will follow guidelines developed jointly by EPA/CE.

Re-evaluation of sediments which are routinely transported to the ocean for disposal will follow the procedure outlined above. Should the re-evaluation conclude that there is a potential for contamination of the sediments since the last bioassays, CESAM will coordinate with EPA, Region IV prior to any retesting.

A Section 103 Evaluation and any required NEPA documentation will be completed prior to the initial placement of material in the Pascagoula ODMDS. For recurring activities, similar documentation be required on a 5 year basis or prior to each dredging event, whichever interval is longest. For repetitive maintenance events (i.e. Federal navigation project) re-evaluation will be accomplished every three years with the exchange of letters between CESAM Ocean Dumping Coordinator and EPA.

2.4 Timing of Disposal. At present no restrictions have been determined to be necessary for disposal related to seasonal variations in ocean current or biota activity. As monitoring results are compiled, should any such restriction appear necessary, disposal activities will be scheduled so as to avoid adverse impacts. Additionally, if new information indicates that endangered or threatened species are being adversely impacted, restrictions may be incurred.

2.5 Disposal Techniques. No specific disposal technique is required for this site. However, there may be some environmental advantages to disposing suitable dredged material using one of the following procedures.

Disposal in a thin layer over a large portion of the site may be a preferred management technique especially for unconsolidated fine-grained maintenance material. Studies performed utilizing this technique in Mobile Bay and Mississippi Sound indicate a more rapid recovery of the benthos as compared to continuous deposition in a confined area which results in a thicker buildup of dredged material. In view of the large area encompassed by the Pascagoula ODMDS, this type disposal could result in reduced environmental impact.

Due to the predominant current regime in the area, the site is considered to be dispersive, so that erosion and off-site dispersion is expected to occur. Based on the results of the sediment mapping study and current studies, it is desirable to predetermine the disposal methodologies and locations within the ODMDS for disposal of dredged material, at least until sufficient monitoring information has been collected to provide assurance that dispersal does not result in adverse impacts. Since currents tend to be predominantly west-southwest or west-northwest in the proposed area, initial disposal of fine material will be made in the easternmost portions of the selected site, to the extent practical, in order to assure that the material does not migrate offsite.

It also appears, based on geology of the area and analysis of the sediment mapping data, that finer-grained material is more predominant in the central and southernmost portions of the proposed ODMDS. When possible, consideration should also be given to disposal of finer grained-material in this area, with coarser material being disposed in the northern portion of the ODMDS.

The benefits associated with the construction of a submerged berm, wave energy reduction and habitat creation, are currently being investigated as part of the National Underwater Berm Demonstration Project at Mobile, Alabama. Should this type disposal in the ODMDS prove to be beneficial, it is envisioned that a similar technique would be utilized with suitable materials, i.e. material to be dredged during the construction of the authorized improvements to the Federal navigation channel, the construction of Naval Station Pascagoula navigation facilities, or sandy material.

Another submerged structure is included in the Pensacola, FL Offshore ODMDS management plan. In this instance the submerged structure is used to control the placement of fine-grained material within the site. A horse-shoe shaped, 6-foot high, berm is being constructed of sand and a sandy-mud mixture. The berm is open on the western end and fine-grained material will be placed in the eastern midsection of the horse-shoe. The management goal expected to be gained with this plan will be the restriction of movement of the fine-grained materials in the northerly or easterly direction. This goal was developed due to the nature of the resources north and east of the ODMDS. Although no significant resources have been defined in the vicinity of the Pascagoula ODMDS, this technique may prove beneficial if segregation of different types of material within the ODMDS is appropriate.

2.6 Multiple Use Management. The Pascagoula ODMDS is intended for multiple use by a number of entities including the Corps of Engineers, US Navy, Port

of Pascagoula, Ingalls Shipbuilding, Chevron Refinery etc. Each of these users will have different needs relative to quantity, type of material, timing etc., therefore partitioning of the site for specific users may be an appropriate management technique. This could facilitate monitoring and surveillance of individual disposal activities, however, it may not be the most appropriate management technique if beneficial results as described in Section 2.5 above are desired.

3.0 Site Monitoring. Part 228 of the Ocean Dumping Regulations (40 CFR 228) establishes the need for evaluating the impacts of disposal on the marine environment. Section 228.9 indicates that the primary purpose of this monitoring program is to evaluate the impact of disposal on the marine environment by referencing the monitoring results to a set of baseline conditions. The following types of effects will be considered in determining to what extent the marine environment has been impacted by materials disposed at an ocean site:

(1) Movement of materials into estuaries or marine sanctuaries, or onto oceanfromt beaches, or shorelines;
(2) Movement of materials toward productive fishery or shellfishery areas;
(3) Absence from the disposal site of pollution-sensitive biota characteristic of the general area;
(4) Progressive, non-seasonal, changes in water quality or sediment composition at the disposal site, when these changes are attributable to materials disposed of at the site;
(5) Progressive, non-seasonal, changes in composition or numbers of pelagic, demersal, or benthic biota at or near the disposal site, when these changes can be attributed to the effects of materials disposed of at the site; and
(6) Accumulation of material constituents (including without limitation, human pathogens) in marine biota at or near the site.

Impacts will be categorized according to the overall condition of the environment of the disposal site and adjacent areas based on the determination by the management study team assessing the nature and extent of the effects identified in paragraph (b) of this section in addition to other necessary or appropriate considerations."

3.1 Monitoring Objectives. The purposed of the site monitoring plan for the Pascagoula ODMDS are:

- Delineation of the geographic location of the discharged dredged material;
- Determination of the direction, if any, in which the discharged dredged material is migrating, and the extent of movement;
- Delineation of the effect, if any, on the ecology within and outside the ODMDS.

3.2 Pre-Disposal Monitoring. The results of investigations presented in this EIS will serve as the main body of baseline data for the monitoring of the impacts associated with the use of the Pascagoula ODMDS. This baseline data includes the following surveys: benthic macroinvertebrates, fisheries, water and sediment chemistry, sediment mapping, physical oceanographic conditions, bathymetry, side scan sonar, and video photography. These studies include:

a. U.S. Army Corps of Engineers' Mississippi Sound and Adjacent Areas Study (Kjerfve and Sneed 1984; Raytheon Ocean Systems Co. 1981; CE 1984; and B.A. Vittor and Associates 1982);

b. Harmon Engineering & Testing 1984a; and

c. Surveys conducted during the site designation phase in November 1986 and February/April/July 1987 (EPA 1987), and a survey planned for August 1990.

Bathymetric surveys of a planned placement area within the ODMDS will be conducted prior to use. No additional pre-disposal monitoring at this site is proposed.

3.3 During Disposal Monitoring. The purpose of this monitoring effort is to determine the location, amount, and timing of dredged material placement within the site. Each user of the Pascagoula ODMDS will be required to prepare and operate under an approved electronic verification plan for all disposal operations. As part of this plan the user will provide an automated system that will continuously track the horizontal location and draft condition (vertical) of the disposal vessel from the point of dredging to the disposal area, and return to the point of dredging. At a minimum the following data will be required:

a. Date;
b. Time;
c. Vessel Name;
d. Number of Scows in tow and distance from vessel or other vessel used;
e. Vessel position, at pre-specified times when within the channel limits, between the dredging area and the disposal area, and when within the disposal area limits, and similar intervals on the return vessel and scow(s) to the dredging area;
f. Dredge scow or vessel draft, coincidental measurement with "e" above;
and
g. Volume of material disposed.

The user will be required to prepare and submit daily reports of operations and a monthly report of operations for each month or partial month's work.

In addition, water quality sampling relative to turbidity during disposal may be required as specified in State Water Quality Certification documents.

3.4 Post Disposal Monitoring. Based on the type and volume of material disposed, monitoring surveys will be used to determine movement of material and impacts to the site and adjacent area. A tiered approach will be utilized to determine the level of monitoring effort required following each disposal event. At a minimum bathymetry and sediment mapping will follow all disposal events, until deemed unnecessary. Bathymetric surveys will be the responsibility of the dredged material generator while EPA will be responsible for sediment mapping activities.

The rationale for a phased or tiered monitoring approach is based upon that delineated in the EPA/CE Draft Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters (1990). The basic philosophy behind the tiered approach is to provide for proper oversight of ocean placement activities at the Pascagoula ODMDS while properly managing personnel and fiscal resources. Because a portion of the Pascagoula ODMDS has been used historically without significant environmental impacts, we believe that the phased approach would provide the necessary information to determine the need for additional monitoring and be the most expeditious approach. This phased approach is especially appropriate for repeated disposal operations such as occur during maintenance of projects. For construction (new work) dredged material placement operations, which typically involve large quantities of material, variations of the phased approach may be appropriate.

With the phased approach, an interagency team, consisting of representatives of the State of Mississippi, U. S. Army Corps of Engineers, Environmental Protection Agency, National Marine Fisheries Service, and the user, would be established at the time when use of the ODMDS is proposed. This team would suggest appropriate monitoring techniques and level of monitoring required for a specific action. These suggestions should be based on type of disposal activity (i.e. O&M vs. construction), type of material (i.e. sand vs. mud), location of placement activity within ODMDS, or quantity of material. EPA and CE will ultimately determine the actual monitoring activities to be required.

Within six (6) months of completion of a disposal event, detailed bathymetric surveys of the placement area would be completed. Within twelve (12) months of the event, sediment mapping of the placement and adjacent areas would be complete. The interagency team would meet to review the results of these efforts and determine the need for additional information. This need would be based on variations from the expected scenario associated with the specific disposal event. Should the results of the bathymetric and sediment mapping surveys conform with the expected scenario no additional monitoring would be required for the disposal event. At the next event, this phased monitoring approach would be applied in a similar fashion. At some point in time, to be agreed upon by the interagency team, a reassessment of the site would be undertaken. At a minimum, this reassessment would include benthic macroinfaunal and sediment chemistry surveys. Additional surveys for water quality or the use of remote sensing equipment might also be required.

4.0 Monitoring Techniques. A number of techniques have proven to be useful in monitoring ODMDSs in the northern Gulf of Mexico and are presented below. This is not to be taken as an exhaustive list of possible techniques or recommendation for specific methods, but rather a general discussion.

4.2 Material Tracking.

4.2.1 Discharged Material Geographic Extent, Thickness, and Movement. Several methodologies can be utilized to characterize the extent of the discharged sediments. Precision bathymetry or vertical sediment profiling can be utilized. Additionally, high resolution (shallow) acoustic subbottom profiling may be utilized to determine the vertical extent of the material. Sidescan sonar and sediment mapping can be utilized to determine the geographic extent of the discharged material. A planned sequence of surveys may be necessary to determine whether movement is occurring, as well as the nature and extent of the movement.

4.2.1 Sediment Characterization. One means of sediment mapping utilizes gamma spectrometry (sand sized material) and x-ray fluorescence (XRF) (fine-grained material) analysis. An initial characterization is performed just prior to disposal to establish a baseline of elemental composition of the native sediment. Data obtained during this survey would be used to construct computer generated maps showing isopleths of selected elements throughout the surveyed area. Upon completion of the disposal activity, a second survey is performed to obtain a new characterization of sediments with the dredged material in place. Comparison of pre-disposal and post-disposal elemental characterizations is utilized to determine the distribution of disposed dredged material.

4.3 Disposal Effects. Bottom sampling may include sampling for benthic macroinvertebrates, sediment chemistry and sediment particle size as discussed below.

4.3.1 Benthic Macroinvertebrates. The number of replicates taken at each station will be determined based on sampling technique to be employed, i.e., box core, grab, or diver collected core samples, and an evaluation of the species area curves from the site designation surveys. Past experience in the area of the Pascagoula ODMDS indicates that 5 box cores or 13 dover collected cores is sufficient to describe species evaluation curves. All samples will be sieved through 0.5 mm screen in the field, placed in appropriate containers, and immersed in 10% formalin/seawater solution with rose bengal stain for transport to the laboratory. Species identification will be to the lowest practicable level. Data analyses will include, at a minimum, species diversity, evenness, and richness and Q- and R- mode cluster analyses.

4.3.2 Sediment Chemistry. Sediment should be collected from these same stations for sediment chemical analysis. All cores will be refrigerated and iced for return to the laboratory for analysis. Analyses may include a metals scan, pesticides, chlorinated hydrocarbons, oil and grease, and nutrients (NH_3, NO_2+NO_3-N, TKN).

4.3.3 Sediment Particle Size. Samples should be collected for sediment particle size analyses simultaneously with and in the same manner as sediment chemistry sampling. All cores will be carefully decanted and frozen aboard ship prior to shipment to the laboratory. The samples will be processed according to the wet sieve Modified Wentworth method.

4.3.4 Water Quality Sampling. Water quality may be sampled at each of the above stations. Water quality sampling may consist of dissolved oxygen, salinity and temperature profiles at 5-foot increments from surface to bottom. Light extinction profiles will be conducted at 10-foot increments from surface to bottom. After determination of the 90, 50, and 10% light levels, water samples will be collected, composited, and a sample extracted and filtered for chlorophyll-a analysis. Water samples should be collected at surface, mid-depth, and bottom at each sampling station for nutrient analysis.

4.3.5 Demersal Fishes. Demersal fishes may be collected along transects established within the ODMDS and the area adjacent to the ODMDS using a 40-foot otter trawl equipped with a 0.25 inch mesh liner. A minimum of four (4) transects should be established in each area. Trawl times will be standardized at 20 minutes. Trawl catches from each station will be placed in appropriate containers and fixed with 10% formalin. Fish specimens larger than 4 inches standard length will be slit to allow proper fixation.

4.3.6 Other Techniques. Additional sampling techniques such as side scan sonar, video records, diver accomplished still photography, vertical sediment profiling may be utilized as necessary to determine the overall effects of disposal in the Pascagoula ODMDS. Close coordination between the EPA, COE, the State of Mississippi, and the user will be maintained during development of the detailed monitoring plan and evaluation of results. Should the initial disposal into the ODMDS result in unacceptable adverse impacts further studies may be required to determine the persistence of these impacts, the extent of the impacts within the marine system, and/or possible means of mitigation. In addition, the proposed management plan may require revision based on the outcome of the monitoring program.

5.0 Reporting and Data Formatting. Any data collected will be provided to the Interagency Team. Data will also be provided to other interested parties to the extent feasible. Data will be provided in an appropriate format to be specified by the Interagency Team (e.g. National Ocean Data Center (NODC) format). Any reports generated during the monitoring will indicate how the survey relates to the Site Management and Monitoring Plan (SMMP) and list previous surveys from the Pascagoula ODMDS and other ODMDS within the northern Gulf of Mexico, as appropriate. The report will provide data interpretations, conclusions, and recommendations. Appropriate reporting deadlines will be established for each monitoring activity.

5.1 Modification of the ODMDS SMMP. A need for modification of the use of the Pascagoula ODMDS because of unacceptable impacts is not anticipated. However, should the results of the monitoring surveys indicate that continuing use of the ODMDS would lead to unacceptable impacts, then either the ODMDS Management Plan will be modified to alleviate the impacts or the location of the ODMDS would be modified.

SECTION D-3

DRAFT SUPPLEMENTAL

FISH AND WILDLIFE COORDINATION ACT REPORT

SUPPLEMENTAL

FISH AND WILDLIFE COORDINATION ACT REPORT

PASCAGOULA HARBOR, MS

Submitted to

U.S. Army Corps of Engineers
Mobile, AL

Prepared by

U.S. Fish and Wildlife Service
Fish and Wildlife Enhancement
Daphne, AL

November 1989

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INTRODUCTION

The U.S. Army Corps of Engineers (Corps) is currently studying several disposal alternatives for dredging associated with the Pascagoula Harbor, Mississippi, Project. Some of these disposal alternatives were neither considered in the feasibility report of 1984 nor studied in detail from an engineering or environmental perspective. As such, this Supplemental Fish and Wildlife Coordination Act Report (FWCAR) will focus on the beneficial and adverse impacts of the proposed disposal alternatives and, in the case of unavoidable adverse impacts, recommend mitigation measures. Where applicable, the benefits and costs of certain mitigation features are provided.

The existing navigation project was authorized by the River and Harbor Acts of March 4, 1913; March 4, 1915; May 17, 1950; September 3, 1954; July 3, 1958; July 14, 1960; and October 23, 1962, and October 17, 1986 (the project under consideration). This supplemental report has been prepared in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

DISCUSSION OF PREVIOUS REPORTS

In addition to our September 1984 FWCAR on the Pascagoula Harbor, Mississippi, Project, the Fish and Wildlife Service (FWS) also provided a FWCAR for the Naval Homeport at Pascagoula to the Department of the Navy. Each of those reports generally addressed the disposal sites that are discussed in this supplemental report with the exception of renourishment

of Round Island. For each of these reports, the FWS conducted a habitat evaluation procedure (HEP) analysis in cooperation with Corps personnel.

The Tenneco site, which will be a major feature of this supplemental report in terms of adverse impacts and mitigation, was also given serious consideration by the U.S. Navy as a homeport facility. In addition, the Corps had previously selected a portion of the Tenneco area for disposal. The site was evaluated for both the Navy and Corps projects with the use of HEP. This data will be used for specific mitigation computation and cost analysis in association with this supplemental report. In previous project planning, wetland delineation within the Tenneco site became a major controversial issue. As such, the Tenneco site was put under a special case category by the Environmental Protection Agency (EPA) for final wetland determination per requirements of the Clean Water Act and EPA/Corps Agreements.

Our September 1984 FWCAR also addressed the reconstruction of the Grande Batture Islands in terms of the expected beneficial and adverse impacts. This supplemental report will further address the alternatives of reconstructing the Grande Batture Islands and renourishing Round Island. The amount of material and size of the former alternative has been scaled from that originally proposed and analyzed in our 1984 report. As stated in that report, the FWS currently favors the disposal of dredged material either in the gulf or on relatively low productive uplands. However, we would be amenable to the reconstruction of the Grand Batture Islands provided its design is environmentally acceptable.

STUDY AREA

This supplemental report mainly addresses the portion of the project area located along the Bayou Casotte channel and within the Mississippi Sound (Fig. 1). Areas affected within and adjacent to the Sound are Pt. Aux Chenes, the Tenneco site, and Round Island.

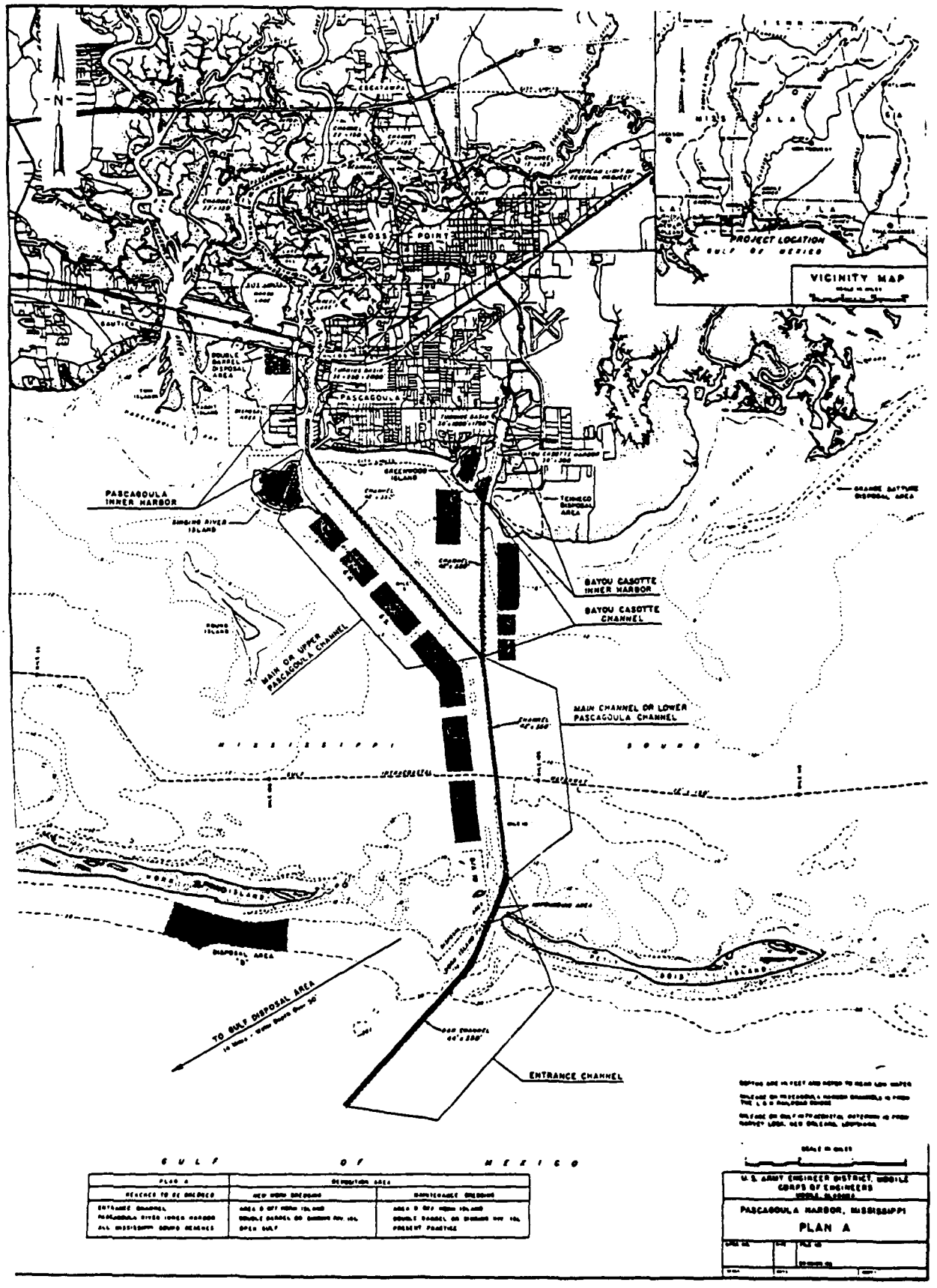

VICINITY MAP
PROJECT LOCATION
PASCAGOULA
INNER HARBOR
BAYOU CASOTTE
INNER HARBOR
BAYOU CASOTTE
CHANNEL
MAIN OR UPPER
PASCAGOULA CHANNEL
MAIN CHANNEL OR LOWER
PASCAGOULA CHANNEL
TO GULF DISPOSAL AREA
ENTRANCE CHANNEL
GULF OF MEXICO
U.S. ARMY ENGINEER DISTRICT, MOBILE
CORPS OF ENGINEERS
PASCAGOULA HARBOR, MISSISSIPPI
PLAN A

Figure 1

Mississippi Sound is approximately 81 miles long, 7 to 15 miles wide, and averages 9.9 feet in depth (Eleuterius, C., 1976a). The average tidal range within the project area is approximately 1.5 feet. Tides are diurnal with a period of 24.8 hours. The major tidal wave enters the project area between Horn and Petit Bois Islands and splits in both an east and west movement. Circulation within the study area is greatly influenced by tide, winds, and freshwater discharges. Winds, especially from the east/west vectors, can tremendously affect circulation patterns within the Sound. This is demonstrated in the Mississippi Sound and Adjacent Areas Study (U.S. Army COE, Mobile District, 1983). Wind also plays a major role in erosion of the coastline, which is a chronic problem within portions of the project area and especially the Pt. Aux Chenes area.

Salinities within the project area (from the Pascagoula River to Pt. Aux Chenes Bay and south to the islands) are greatly influenced by freshwater inflows from the Pascagoula River. During winter and spring flood periods, the salinities range from 1 to 29 ppt. (U.S. Army COE, Mobile District, 1983). During low flow periods of summer and early fall salinities may range from 5 to 29 ppt.

Submerged and emergent vegetation within the Sound are highly productive fish and wildlife habitats. A major tract of estuarine emergent wetlands is located north of Pt. Aux Chenes Bay. Tidal marshes are also located at the Tenneco area and upper reaches of Bayou Casotte.

PROJECT DESCRIPTION

A detailed discussion of the Pascagoula Harbor Project is contained in our 1984 report. This supplemental report specifically addresses the dredging and disposal alternatives for the Bayou Casotte channel (Fig. 1). Under this proposed project the existing 38-foot channel (Bayou Casotte and Lower Pascagoula Channel) would be deepened to 42 feet. The lower Pascagoula Channel is currently 350 feet and will not be widened. The Bayou Casotte Channel will be widened from 225 to 300 feet. The portion (1,500 feet) of this channel within the vicinity of Chevron's pipeline crossing will only

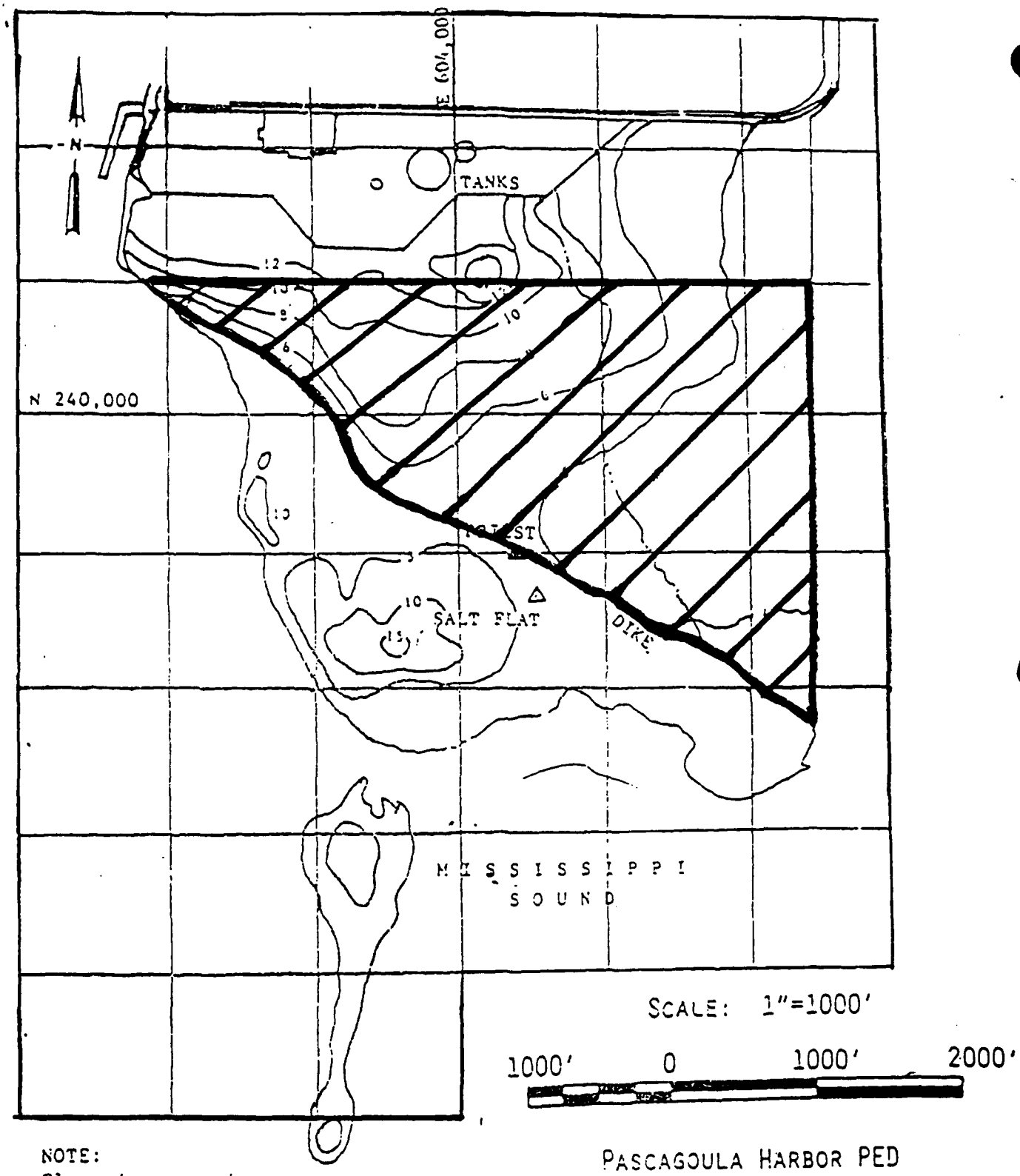
be widened to 250 feet. About 4 million cubic yards (cys) of material will be dredged from the Bayou Casotte Channel. A turning basin will also be constructed near the mouth of Bayou Casotte. Several disposal alternatives are being proposed for material dredged from this channel. These are filling all or portions of the Tenneco site, reconstruction of the Grande Batture Islands, and renourishment of Round Island. In regard to Tenneco, four different disposal dike designs are being proposed for the placement of dredged material at this location. Once the Tenneco area is filled (one dredging), it is to be used only for private industrial development. The following is a description of each of these dike designs.

Tenneco

1. Alternative 1 will require placing about 2.9 million gross cys (1.8 million in situ) of dredged material within the confines of the old diked area (Fig. 2). About 45 acres of scrub/shrub uplands, 116 acres of scrub/shrub wetlands, and 14 acres of herbaceous wetlands will be filled. This entire (wetland and uplands) area encompasses 175 acres.

2. Alternative 2 will require the filling of a portion of the old diked area and tidal marshes on the west side of the site (Fig. 3). About 3.0 million gross cys (1.9 million in situ) of disposal material would be placed at Tenneco. Habitats filled with this alternative are 61 acres of scrub/shrub uplands, 72 acres of scrub/shrub wetlands, 21 acres of herbaceous uplands (Cogon grass), and 29 acres of tidal marsh. The entire area includes about 183 acres.

3. Alternative 3 is similar to Alternative 2 except it requires more filling on the inside portion of the old diked area (Fig. 4). About 4 million gross cys (2.6 million in situ) of fill is required with this alternative. About 61 acres of scrub/shrub uplands, 127 acres of scrub/shrub wetlands, 5 acres of herbaceous wetlands, 21 acres of herbaceous uplands,

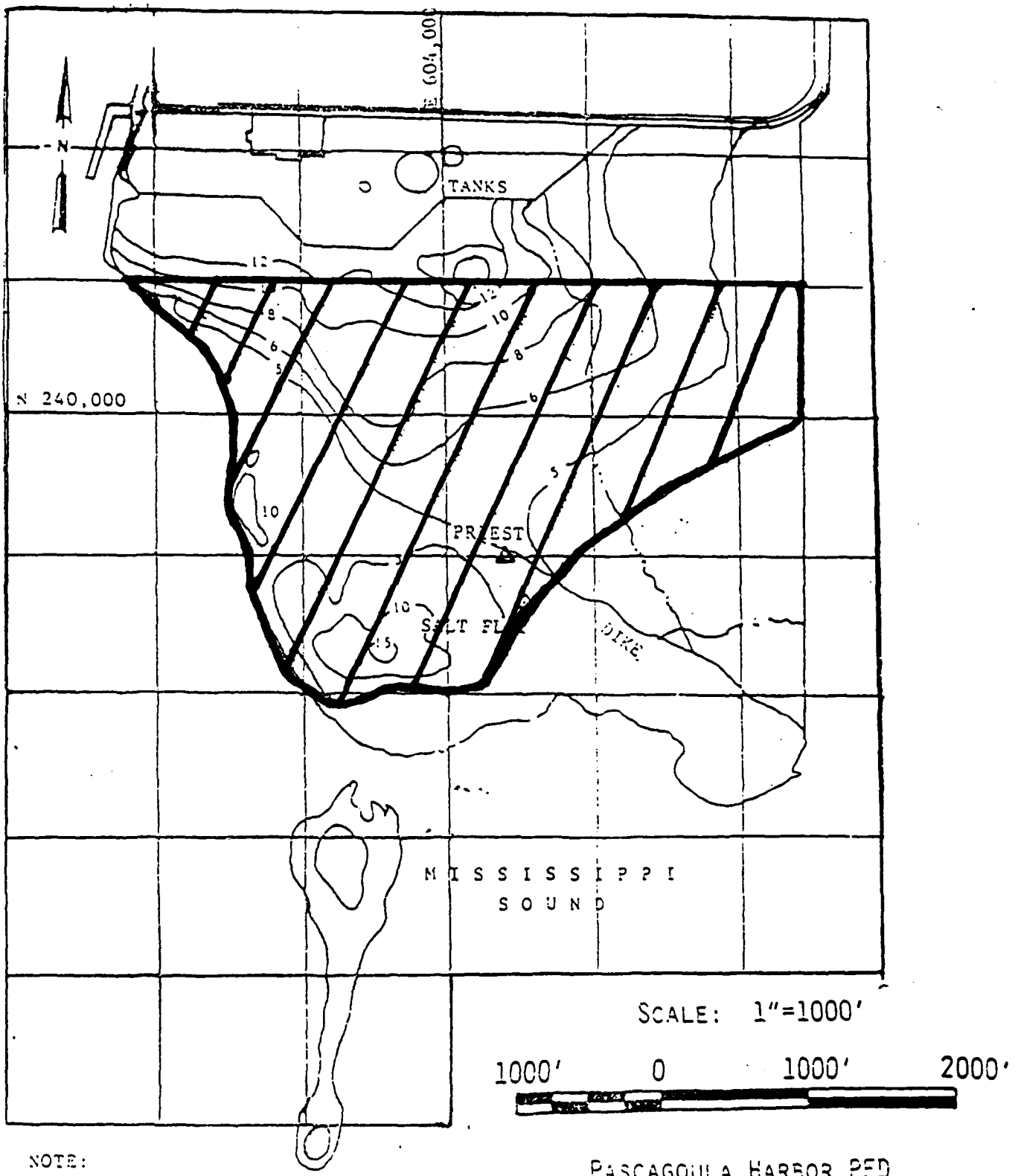


NOTE:
Elevations are in feet above NGVD.

PASCAGOULA HARBOR PED
"TENNECO SITE" PROPOSED DISPOSAL SITE

DISPOSAL ALTERNATIVE
NUMBER ONE

Figure 2



NOTE:
Elevations are in feet above NGVD.

PASCAGOULA HARBOR PED
"TENNECO SITE" PROPOSED DISPOSAL SIT

DISPOSAL ALTERNATIVE
NUMBER TWO
Figure 3

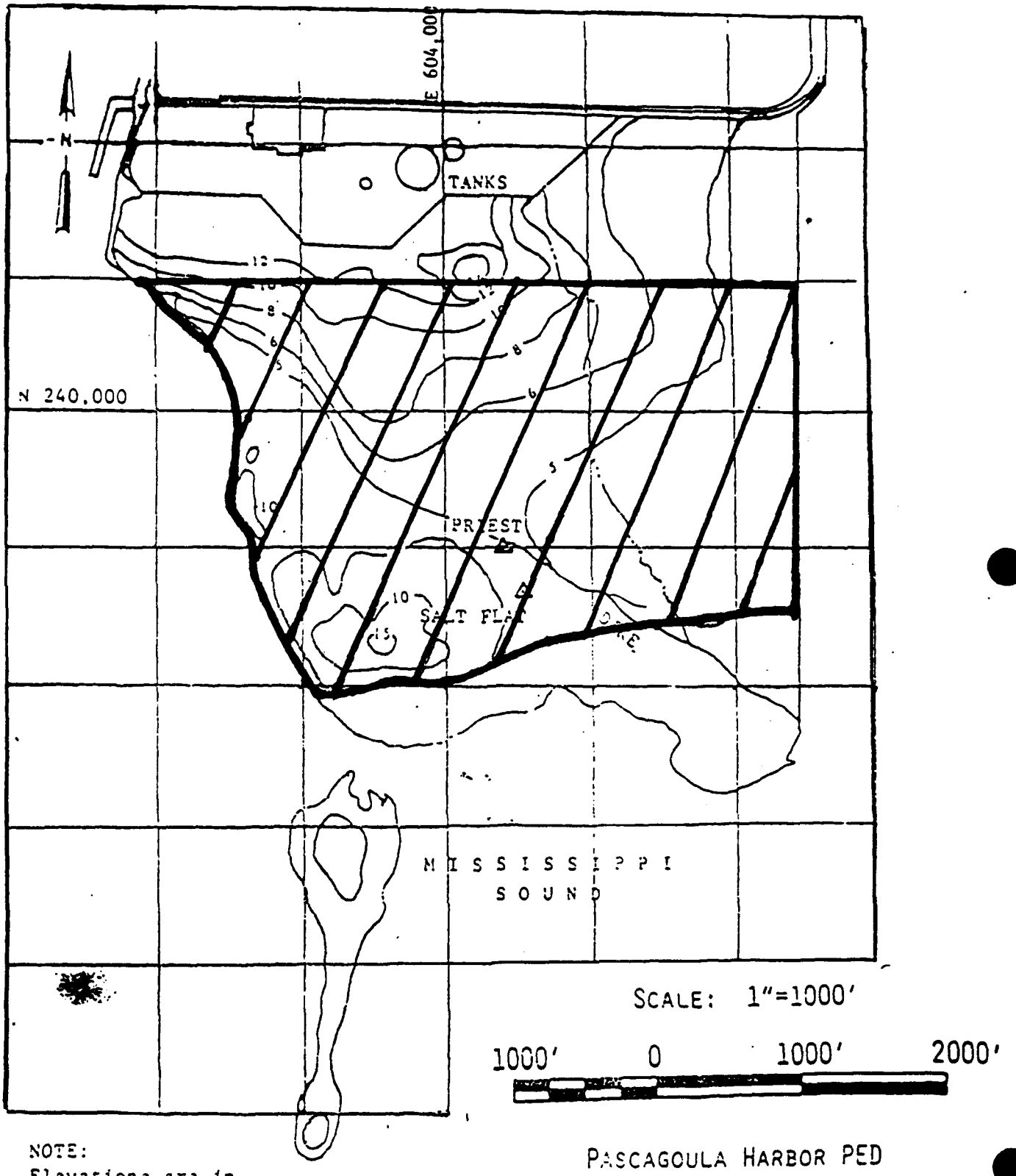


Figure 4

DISPOSAL ALTERNATIVE
NUMBER THREE

and 34 acres of tidal marshes would be filled for a total impact area of 248 acres.

4. This alternative would require filling 61 acres of scrub/shrub uplands, 127 acres of scrub/shrub wetlands, 14 acres of herbaceous wetlands, 21 acres of herbaceous uplands, and 58 acres of tidal marshes (Fig. 5). About 4.6 million gross cys (3 million in situ) of fill would be placed at Tenneco. The impacted area would encompass 281 acres.

Grande Batture Islands

This alternative would require the use of about 6 million cys of dredged material for purposes of reconstructing the Grande Batture Islands. This amount is less than was previously proposed by the Corps during the 1984 feasibility report stage. The construction would begin at the Alabama/Mississippi line and extend west to the approximate historical limit of the Grande Batture Islands chain. As currently proposed by the Corps, hay bales would be used to reduce wave energies to allow vegetation to become established for stabilizing the island. Hay bales are considered by the Corps to cut the cost of rip-rap and eliminate the need to dig channels for purposes of transporting this rock into the project area. The FWS has reservations as to the effectiveness of hay bales for this purpose (see Discussion Section). Some of the fill on the northern side would be sloped to elevations conducive for marsh establishment. The middle portion of the island would also be vegetated.

Round Island

No specific design or volumes of material have been provided for this alternative. If further pursued, the dredged material would be pumped to areas experiencing erosion. One of the more notable being on the southwest side of the island in the area of the old light house. This alternative would likely be used in combination with one of the others in view of the limited amount of dredged material required for this renourishment.

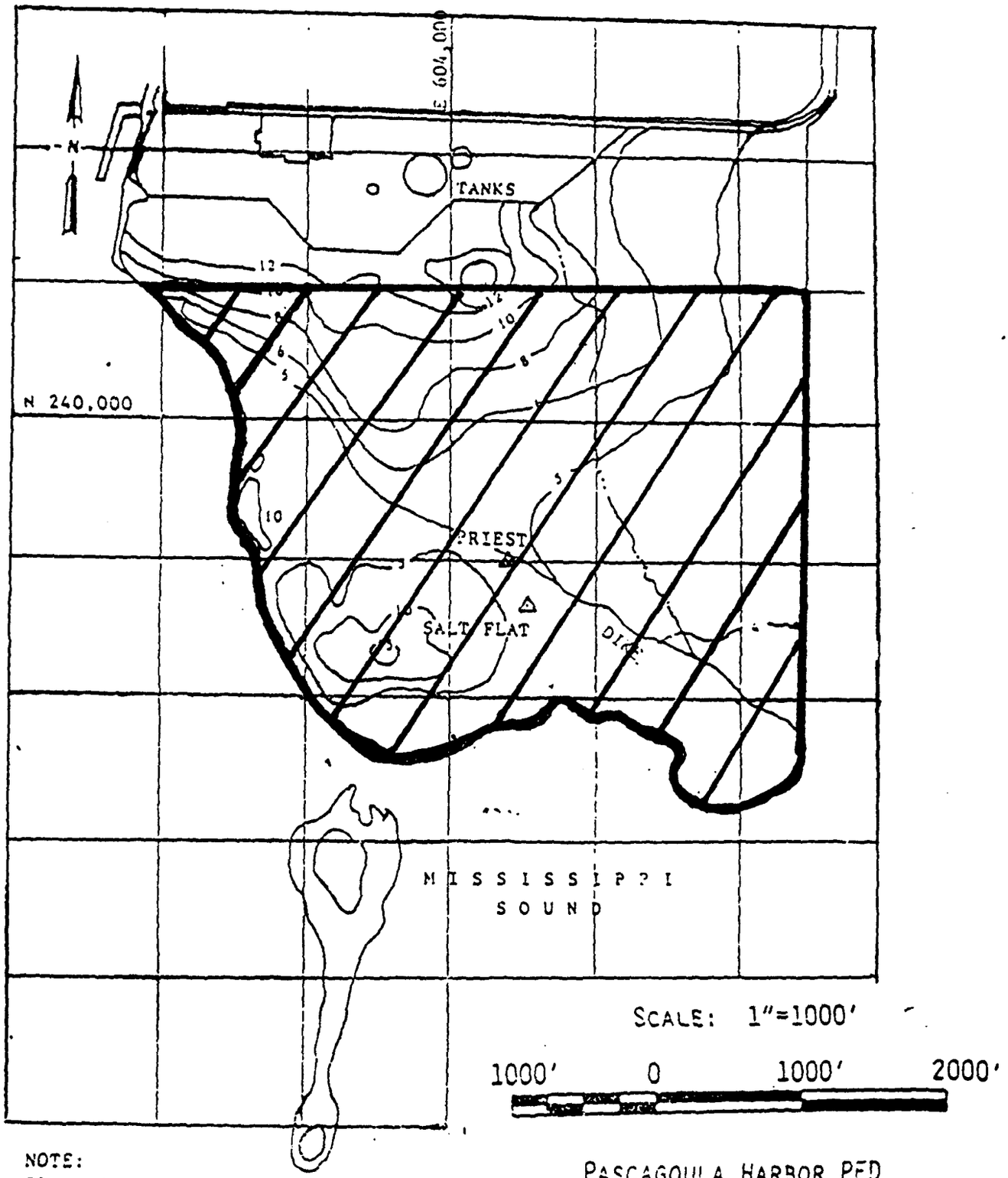


Figure 5

DISPOSAL ALTERNATIVE
NUMBER FOUR

FISH AND WILDLIFE RESOURCES

Our September 1984 FWCAR provides a detailed characterization of the various fish and wildlife resources within the overall project area. For purposes of this supplemental report, existing and future without project conditions will specifically focus on primary areas of impact which are: 1) Tenneco, 2) Grande Batture Islands/Pt. Aux Chenes, and 3) Round Island.

Tenneco (existing)

Both herbaceous and scrub/shrub wetlands exist within the old levees at the Tenneco site. Wetland grasses include such species as threesquare (Scirpus spp.), black needlerush (Juncus roemerianus), saltmeadow cordgrass (Spartina patens), and giant cordgrass (Spartina cynosuroides). The scrub/shrub wetlands consist of groundsel-bush (Baccaharis halimifolia), (Iva frutescens), and wax myrtle (Myrica cerifera). Much of the scrub/shrub understory is vegetated with saltmarsh fimbristylis (Fimbristylis castanea), leafy three square (Scirpus robustus), and saltmeadow cordgrass (Spartina patens).

About 58 acres of tidal wetlands occur outside of the Tenneco dike that runs in a southeast to northwest direction. Wetland species common to these tidal areas include Spartina alterniflora, Spartina patens, Juncus roemerianus, and Scirpus spp. Some upland habitat (scrub/shrub) is scattered throughout the Tenneco si The major portions of this habitat type are confined to the western end of the property. Upland vegetation is also located outside of the dikes on the southwest side of the property. This upland vegetation mainly consists of Baccaharis and Iva and is located on an old spoil disposal mound which is almost surrounded by water. Previous evaluations of the Tenneco area have required a detailed characterization of the habitat types and acres of the entire Tenneco site (Table 1).

Table 1. Acreage of various habitat types at the Tenneco site

127 acres of scrub/shrub wetlands
14 acres of herbaceous wetlands
58 acres of tidal wetlands outside of the old Tenneco dike
61 acres of scrub/shrub uplands
21 acres of herbaceous uplands (Cogon grass)

While wetlands within the confines of the old Tenneco dike are limited in terms of their fishery value, this vegetation does interact with the adjacent marine environment during high storm surges and hurricanes. This detrital material provides a vital food component of lower food chain organisms. A small breach on the southeast side of the dike also provides an avenue for exchange of water during high tide and heavy rainfall. The tidal wetlands and streams south of the dike provide excellent habitat for a variety of marine organisms.

The wildlife values of various wetland and upland habitat types within the Tenneco area have been well documented. The wetlands provide food and cover for species such as muskrat, rabbit, fox, nutria, small raptors, wading birds, rails, migratory waterfowl, and songbirds. Previous habitat evaluations of this area show the habitat value for some of these species to be excellent. The upland scrub/shrub habitat, while not as valuable as wetland types, also provides habitat for wildlife species such as rabbit, fox, raccoon, and songbirds.

Tenneco (without the project)

It is likely that future pressures to fill the Tenneco area for private industrial use will continue. However, since EPA has determined this area as a special case in terms of its wetland jurisdiction, the probability of any wetlands being impacted without appropriate mitigation is remote. Thus, the future without project projections should be that the wetland areas will remain as such, or in cases of unavoidable impacts, be adequately mitigated. The tidal wetlands (58 acres) outside and south of the old levees should continue to erode. Between 1972 and 1981 about 25 acres of lands were lost, and between 1981 and 1985 approximately 3 acres

were lost. Based on this comparison, the FWS believes that a loss of 1 acre a year over the 50-year project could be reasonably assumed. At this rate about 50 acres of tidal wetlands would be eroded by year 50. This would not result in a total loss of fish and wildlife habitat since the eroded areas would be converted to shallow water habitat. However, since tidal wetlands are considered of higher value than shallow waters, some mitigation credit for preventing such erosion could be given.

Grande Batture Islands/Pt. Aux Chenes (existing)

The reconstruction of the Grande Batture Islands would have an affect on the wetlands and open waters within the Pt. Aux Chenes area. The Pt. Aux Chenes wetlands are primarily saline and interact with many tidal streams and small bayous. Vegetation common to this area consists of Juncus roemerianus, Spartina patens, Spartina cynosuroides, Spartina alterniflora, and Distichlis spicata. As stated in our September 1984 FWCAR, these wetlands and adjacent open waters provide excellent habitat for both fish and wildlife. Fish and shellfish such as spotted seatrout, redfish, flounder, menhaden, shrimp, oysters, and crabs utilize these marshes and coastal waters for food and cover.

Wildlife species common in these wetlands include nutria, mink, muskrat, raccoon, rabbit, small mammals, raptors, wading birds, rails, and song birds. These coastal marshes are also extremely valuable to migratory waterfowl and are a vital component of the North American Waterfowl Management Plan. This general area has been identified as a project site under the Coastal Mississippi Wetlands Initiative as part of that plan. The Service has recently acquired over 4,000 acres of savanna and coastal marsh north and east of Pt. Aux Chenes Bay. This tract will soon become part of the proposed Grand Bay National Wildlife Refuge that should eventually encompass about 12,000 acres of both coastal marshes and freshwater wetlands.

Grande Batture Islands/Pt. Aux Chenes (without the project)

The entire Grande Batture Islands have eroded to the extent that a shallow shoal is all that remains of this island chain. As such, the wave energies once buffered by these islands will likely be felt in full force with subsequent increased erosion of the marsh on the north shore of Pt. Aux Chenes Bay. This erosion rate will likely be augmented by several factors which include: 1) future erosion of the remnants of the Grande Batture Islands, resulting in a greater fetch; 2) increased rise in sea levels; and 3) increased wave action due to the continued westward drift of Petit Bois Island.

Round Island (existing)

Round Island is located southwest of Singing River Island. The island includes about 110 acres and is vegetated with pine trees and emergent vegetation. It is comprised of sandy wet soils or loamy sands of the tidal marsh association (Jackson County Planning Commission, 1976). Marshes predominate in low areas, which are tidal-influenced, and surface waters are mostly salty. Round Island is subject to littoral drift and inundation from severe storms and hurricanes. Wildlife consists of cottontail rabbits, mice, and birds. The island is an important nesting and resting area for ospreys and great blue herons. This island is continuing to experience a severe erosion rate, especially in the area of the old Lighthouse on the southwest side.

Round Island (without the project)

With this alternative, the erosion of the island will continue. The rate of erosion may be difficult to predict since climatic conditions such as winds and storms are controlling factors. However, before an accurate assessment of beneficial or adverse impacts resulting from project construction can be made, a detailed evaluation of the ongoing erosion rate must be completed.

Endangered Species

A listing of fish and wildlife species that presently require consideration under the Endangered Species Act and are associated with the project area is contained in our 1984 report. The FWS Endangered Species Field Office determined in our December 21, 1983, letter to the Corps that this project as proposed would not have significant adverse impacts on endangered species in the area. Since the 1984 report, the FWS has initiated a red wolf recovery program on Horn Island. In addition, bald eagles are also being released there. However, since there will be no work (disposal, etc.) on this island, it does not appear that this project as presently proposed will affect these species. If future alternatives do require construction on or near Horn Island, the Corps should coordinate this action with the FWS.

We also recommended that the Corps take every precaution in fulfilling its obligation to ensure that those species either listed or being reviewed for possible proposed listing under the Endangered Species Act receive adequate consideration. Under the Endangered Species Act, it is the responsibility of the Federal action agency to determine the actual presence of listed species and the anticipated impact of the project on those species. Agencies are required to initiate consultation with the FWS to determine if the expected impact will jeopardize the continued existence of that species.

HABITAT EVALUATION METHODOLOGY

Our September 1984 FWCAR specifically explains the Habitat Evaluation Procedures (HEP) used for the impact analysis of this project. Both the Tenneco and Pt. Aux Chenes/Grande Batture areas were evaluated using this procedure. These evaluations have been used for purposes of analyzing positive and negative impacts of the proposed Tenneco dike designs. We believe that the restoration and preservation of Round Island would offset the loss of any adverse open water impacts. Thus, there is no justification for implementing HEP for impact or mitigation analyses with

this specific alternative. Furthermore, if the restoration design of the Grande Batture Islands is acceptable from an environmental perspective, it would not likely require any mitigation. Thus, for purposes of this supplemental report, only those impacts at Tenneco were evaluated using HEP.

PROJECT IMPACTS OF EACH DISPOSAL ALTERNATIVE

Tenneco

Four disposal designs are being considered for the Tenneco site (Figs. 2,3,4,5). All four designs involve a one-time filling of the project area for the purpose of providing development sites for private interests. Habitat evaluation procedure analyses were applied to each design for impact and mitigation determinations. Both fish and wildlife species were used for these evaluations. The fish and wildlife losses of each design are quantified by the use of HEP. The average annual habitat unit (AAHU) losses are provided in Tables 2,3,4,&5. The species that were evaluated and their respective habitat types are as follows: brown shrimp (tidal emergent wetlands), swamp rabbit (wet scrub/shrub and wet herbaceous), clapper rail (tidal emergent), and indigo bunting (upland scrub/shrub).

Alternative 1 (Figure 2) would result in the loss of 116 acres of scrub/shrub wetlands, 14 acres of herbaceous wetlands, and 45 acres of scrub/shrub uplands (Table 2). Under this design no tidal marshes would be filled and fishery impacts would be limited to the loss of vegetative material produced within the Tenneco area for periodic export to the open estuarine environment.

Table 2
AAHU Changes with Alternative 1

Species Name	Habitat Type	AAHU With	AAHU Without	AAHU Change
Shrimp	Tidal Marsh	19.14	19.14	.00
Swamp rabbit	Wet Scrub/Shrub	7.26	83.19	-75.93
Clapper rail	Tidal Marsh	26.40	26.40	.00
Indigo bunting	Upland Scrub/Shrub	12.34	45.75	-33.41
			Total	-109.35

Alternative 2 (Figure 3) would eliminate the filling of about 14 acres of herbaceous vegetation on the southeast portion of the diked Tenneco site. However, it requires the filling of 29 acres of tidal marsh. In addition, about 72 acres of wet scrub/shrub habitat, 61 acres of scrub/shrub uplands, and 21 acres of herbaceous uplands would be filled inside the Tenneco area (Table 3).

Table 3
AAHU Changes with Alternative 2

Species Name	Habitat Type	AAHU With	AAHU Without	AAHU Change
Shrimp	Tidal Marsh	5.55	19.14	-13.59
Swamp rabbit	Wet Scrub/Shrub	41.13	83.19	-42.06
Clapper rail	Tidal Marsh	7.65	26.40	-18.75
Indigo bunting	Upland Scrub/Shrub	.53	45.75	-45.22
			Total	-119.61

Alternative 3 (Figure 4) is similar to Alternative 2 but requires more fill in the southeast section of the diked portion of the Tenneco property. With this design, about 34 acres of tidal marsh, 127 acres of wet scrub/shrub, 5 acres of herbaceous wetland vegetation, 61 acres of scrub/shrub uplands, and 21 acres of herbaceous uplands would be filled (Table 4).

Table 4
AAHU Changes with Alternative 3

Species Name	Habitat Type	AAHU With	AAHU Without	AAHU Change
Shrimp	Tidal Marsh	3.66	19.14	-15.48
Swamp rabbit	Wet Scrub/Shrub	6.09	83.19	-77.10
Clapper rail	Tidal Marsh	5.04	26.40	-21.36
Indigo bunting	Upland Scrub/Shrub	.53	45.75	-45.22
			Total	-159.16

Alternative 4, (Figure 5) of all the designs, would be the most adverse to both fish and wildlife resources. All of the Tenneco wetlands inside the dike (127 acres of wet scrub/shrub, 14 acres of wet herbaceous) as well as 58 acres of tidal marsh would be filled. In addition, 61 acres of

scrub/shrub uplands and 21 acres of herbaceous uplands would be filled (Table 5).

Table 5
AAHU Changes with Alternative 4

Species Name	Habitat Type	AAHU With	AAHU Without	AAHU Change
Shrimp	Tidal Marsh	.39	19.14	-18.75
Swamp rabbit	Wet Scrub/Shrub	.89	83.19	-82.30
Clapper rail	Tidal Marsh	.54	26.40	-25.86
Indigo bunting	Upland Scrub/Shrub	.53	45.75	-45.22
			Total	-172.12

Grande Batture Islands

This alternative requires about 6 million cys of dredged material from the Bayou Casotte channel to be used for reconstruction of the Grande Batture Islands. As proposed, this fill would be protected from wave action on the south side by use of hay bales. In addition, the northern side of the island would be sloped to elevation conducive to marsh creation.

The fish and wildlife benefits of this reconstruction concept are such that this alternative is also being considered as a mitigation feature for the Tenneco fill (see Discussion Section). While the FWS generally supports this alternative, we continue to have concerns about the amount of fill and the proposed use of hay bales for purposes of reducing wave energy and erosion. We believe the fill material should be restricted to the minimum amount that would fulfill project objectives. In lieu of hay bales, we believe that Lanyard Tubes or other similar methods of confinement-protection would be much more effective in terms of controlling high wave energies and assuring a maximum chance of project success. Past experience involving use of hay bales in Mississippi Sound has been generally unsuccessful. Those failures have occurred in areas with less wave energy than that found at the Grande Batture Islands. Innovative means of erosion control need to be implemented for this project for it to have any chance of longterm success and enable the Corps to achieve the potential benefits set forth below.

Fill associated with this construction will result in the loss of open water habitat. The fishery losses resulting from this fill could be restored by three separate actions: 1) enhancing oyster production in the Pt. Aux Chenes Bay area, 2) establishment of marsh, and 3) prevention of further marsh erosion north of Pt. Aux Chenes Bay.

Oyster production could be enhanced by reducing wave action, and lowering salinities in Pt. Aux Chenes Bay, which in turn would help reduce oyster drill (Thais haemostoma) predation. The Mississippi Bureau of Marine Resources reports that about 4,200 acres of barren bottoms exist in the Pt. Aux Chenes Bay area north of the Grande Batture Islands shoals. High salinity, heavy wave action, and lack of shell substrate are major factors limiting oyster production in this area. It is expected that the reconstruction of the Grande Batture Islands could significantly improve these conditions for oysters. Optimum conditions presently exist in Bangs Lake and it is estimated that about 500 sacks of oysters per acre can be produced here. Federal and State biologists are of the opinion that reconstruction of the Grande Batture Islands would lower salinities and reduce wave energy in the Pt. Aux Chenes Bay area to the degree that oyster production could reach about 75% of that attained in Bangs Lake. This would amount to approximately 375 sacks per acre. If 4,200 acres of waterbottom were covered with shell and seeded, at current prices ($25/sack) this could be worth about $39 million annually (MS Bureau of Marine Resources, 1989). The net benefit of an acre of reef is derived in Appendix A.

It is expected that the renourishment of the Grande Batture Islands would also significantly reduce the ongoing erosion of the Pt. Aux Chenes marshes. Estimates in our 1984 FWCAR stated that, over the 50 years life of this project, about 400 acres of marsh could be saved through this erosion control mechanism. This area has been recently studied by the Mississippi Department of Environmental Quality, Bureau of Geology. Their comparison of 1977 topographic maps and 1988 aerial photos assessed the marshes north of Pt. Aux Chenes Bay from the Mississippi-Alabama line to the western historical limits of the Grande Batture Islands. Some of the most severe erosion is on the eastern side of the Grande Batture Islands.

From this area and 6,000 feet toward the west, erosion rates up to 18 feet/year have been noted. The total annual marsh acreage losses for the entire area that would be affected by the renourishment of the Grande Batture Islands is about 6.5 acres. This rate could be expected to increase over the 50-year project life in consideration of further widening of the Dauphin Island/Petit Bois Island Pass. Our 1984 report had projected a 10-acre per year loss in this area. We also believe that with the properly designed renourishment of the Grande Batture Islands, about 80% of this erosion can be eliminated. Appendix B has an itemized listing of tangible marsh values generated through various activities. These values are based on a 10-acre per year loss. Any increase or decrease from that acreage can be extrapolated from this estimated loss. Based on those tangible values, reducing the annual erosion of 10 acres of marsh by 80% (8 acres) would save an average of 200 acres of marsh worth an annual $237,631.00 over the project life. Recent estimates reveal that 5 acres (6.5 acres x 80% = 5 acres) would be saved each year. This would be worth an annual $148,519.00 over the project life. This value is obviously subject to fluctuate with inflation and possible increases in erosion rates.

The marsh to be created on the north side of the Grand Batture Islands would also help benefit both fish and wildlife resources. While some habitat for open water species would be lost, the benefits to other fish and wildlife resources should help offset these impacts. Furthermore, this plan would avoid filling the Tenneco wetlands and likewise eliminate the cost of mitigating those large habitat losses. For example, if all the Tenneco habitat types (Alternative 4) are filled, our calculations show that 213 acres of wetland creation would be required to compensate for the wildlife losses. In considering that an average cost of creating 1 acre of tidal wetland is approximately $60,000, this alternative could require about $13 million for mitigation alone (see Table 11 in the Tenneco Section of Discussion).

Round Island

As proposed, this alternative should help reduce the ongoing erosion of this barrier island. The major adverse environmental impact would be the loss of shallow water habitat. While the loss might be offset through maintaining this coastal barrier and wildlife habitat, the amount of material and means of stabilizing the island is of utmost importance. Currently, no specific engineering designs or cubic yards of material have been provided. The magnitude of fill and degree of island expansion is naturally of major concern. Expansion should not extend beyond the island's historical dimensions.

DISCUSSION

Resource Categories

To assure consistent and effective recommendations on mitigating adverse effects of land and water development on fish, wildlife, and their habitats, the FWS established a Mitigation Policy (Federal Register Vol. 4, No. 15, January 23, 1981). Within the policy there are four Resource Categories (Table 6) that are used to indicate the necessary level of mitigation.

The FWS has categorized the herbaceous emergent and scrub/shrub wetlands within the Tenneco and Pt. Aux Chenes areas as Resource Category II. These coastal wetlands represent fish and wildlife habitats of extreme importance and are vanishing at an alarming rate.

The FWS also considers oyster reefs within the project area to represent a Resource Category II habitat. Many reefs in the Sound have been altered due to storms or closed to harvest as a result of pollution. Oyster reefs not only provide a lucrative commercial fishery but also create habitat utilized for feeding purposes by many important sport and commercial fish species.

Table 6. Resource Categories for Determining Levels of Compensation Requirements

Resource Category	Designation Criteria	Mitigation Goal
I	Habitat to be affected is of high value for evaluation species and is unique and irreplaceable on a national basis or in the ecoregion section.	No loss of existing habitat value
II	Habitat to be affected is of high value for evaluation species and is relatively scarce or becoming scarce on a national basis or in the eco-region section.	No net loss of inkind habitat value.
III	Habitat to be affected is of high to medium value for evaluation species and is relatively abundant on a national basis.	No net loss of habitat value while minimizing loss of in-kind value.
IV	Habitat is of medium to low value to evaluation species.	Minimize loss of habitat value.

According to FWS mitigation policy, Resource Category II losses should be compensated for by replacing the same kind of habitat value through: 1) physical modification of replacement habitat to convert it to the same type lost; 2) restoration of previously altered habitat; 3) increased management of similar habitat so that the in-kind value of the lost habitat is replaced; or 4) a combination of these measures. However, an exception can be made to this planning goal when different habitats and species available for replacement are determined to be of greater value than those lost, or in-kind replacement is not physically or biologically attainable

in the ecoregion section. In either case, replacement involving different habitat kinds might be recommended, provided that the total value of the habitat lost is recommended for replacement.

The open waterbottoms of Mississippi Sound (Round Island and Grande Batture Islands) and upland scrub/shrub habitats have been classified as Resource Category III. According to FWS policy, we prefer, in most cases, to recommend ways to replace such habitat value losses in-kind. However, if we determine that in-kind replacement is not desirable or possible, then other specific ways may be used to achieve this planning goal, including: (1) substituting different kinds of habitats, or (2) increasing management of different replacement habitats so that the value of the lost habitat is replaced. By replacing certain habitat losses with different habitats or increasing management of different habitats, populations of certain species would be different, depending on the ecological values of the replacement habitat. This would result in no net loss of total habitat value, but might result in significant differences in fish and wildlife populations. The term applied to this concept is "out-of-kind" replacement.

The 21 acres of dry herbaceous grass on the disposal mound of the diked portion of the Tenneco site has been classified as a Resource Category IV. This habitat has very limited value for fish and wildlife resources and, therefore, specific mitigation measures have not been considered.

In accordance with the Council on Environmental Quality guidelines and the FWS's mitigation policy, our recommendations will seek to avoid or minimize adverse project impacts. For impacts that are unavoidable, measures are recommended to compensate for these impacts. Both positive and negative impacts will be assessed where necessary and adequate compensation recommended. Examples in this case would include the filling of the Tenneco wetlands, constituting a negative impact, while preventing erosion of marshes in the Pt. Aux Chenes Bay area would be considered a positive impact.

Tenneco Mitigation

Each of the Tenneco alternatives will result in the loss of productive fish and wildlife habitat. A secondary impact of the Tenneco alternatives also concern the FWS and this specifically regards the intended use of the Tenneco area once it has been filled. As proposed, this area would be used for industrial development and not for continuing disposal of dredged material.

The habitat types requiring mitigation were: 1) tidal emergent wetlands, 2) wet herbaceous, 3) wet scrub/shrub and 4) upland scrub/shrub. All of the wetlands are Resource Category II and the upland scrub/shrub is deemed Resource Category III. Acceptable compensation measures consist of protecting tidal marsh from erosion or creating tidal marsh through restoration or converting low productive uplands to wetlands. These tidal wetlands are Resource Category II habitats and, therefore, are acceptable as out-of-kind replacement.

Both the swamp rabbit (wet scrub/shrub) and Indigo bunting (upland scrub/shrub) habitat unit (HU) losses were mitigated through gains in shrimp HU's resulting from the marsh restoration, creation, or protection measures. The wet scrub/shrub HU's (swamp rabbit) were replaced on an equal HU basis. However, the upland scrub/shrub (Indigo bunting) is considered of less value than tidal marsh (because of its widespread abundance on a regional basis and HU value) and requires less wetland marsh creation for mitigation purposes. We believe that 1 acre of tidal wetlands would compensate for the loss of 3 acres of upland scrub/shrub habitat.

The compensation acreage is based on a ratio derived by dividing the HU losses by the HU's gained from a specified acreage of marsh creation. For this mitigation plan (Table 7), 100 acres of marsh creation was used for this analysis. The ratio of losses to gains is then multiplied by the acreages of marsh used in the computation for deriving the required acreage of compensation. Protection from marsh erosion was also a mitigation option with Alternative 1. This protection, if implemented, would reduce the total loss of HU's occurring from this alternative.

For example, with Alternative 1 there was a total loss of -87.07 HU's (Table 2). The Indigo bunting HU's are divided by 3 since this habitat type (upland scrub/shrub) is considered less valuable than the tidal marsh to be created. Thus, 33.41 divided by 3 = 11.14 + 75.93 = 87.07. A gain (+13.93) in HU's from erosion protection (Table 8) was subtracted from this loss (87.07 - 13.93) to give a total loss of -73.14 HU's. The gain of HU's based on tidal marsh creation for shrimp (on 100 acres) was +54.53 (Table 7).

Table 7
Mitigation Plan 1 (Marsh Creation) Area: 100.00

Species Name	Habitat Type	AAHU With	AAHU Without	AAHU Change
Shrimp	Tidal Marsh	55.53	1.00	+54.53
Clapper rail	Tidal Marsh	76.21	1.00	+75.21
			Total	+129.74

The ratio of HU losses (-73.14) divided by the gains (+54.53) was 1.34. This ratio multiplied by the 100 acres of marsh creation used for this computation reveals that 134 acres of marsh creation in addition to erosion protection would be required to mitigate these project losses. If no erosion protection is conducted, then the required mitigation acreage would be 160. All of the mitigation for the following alternatives was derived by this method. With alternatives 1, 2,and 3 marsh erosion protection is viable and could be used in conjunction with the marsh creation. The amount of acreage protected varies with each alternative.

The following is a discussion of each of the disposal alternatives. Some of the Tenneco disposal cell designs result in much more severe impacts than others as reflected in the required mitigation acreages and cost. The methods and cost of compensation will follow the discussion of the Tenneco alternatives and mitigation requirements. The design and cost of erosion control methods associated with mitigation credit is unknown at this time.

Alternative 1

This plan would require the filling of 45 acres of scrub/shrub uplands, 116 acres of scrub/shrub wetlands, and 14 acres of herbaceous wetland. Losses occurring to each of these habitats would require mitigation.

Both onsite and offsite compensation measures were considered for this alternative. The onsite measures consist of protecting 58 acres of tidal marsh from eroding. It was assumed that the tidal marsh south and west of the southern dike at Tenneco was eroding at 1 acre per year. If not protected, by the end of the project life only 8 acres of the 58 would remain. The FWS would consider this as mitigation provided measures to achieve such protection were environmentally sound and natural tidal regimes could be maintained. A total of +13.93 shrimp HU's were credited for this mitigation method (Table 8).

Table 8
Erosion Protection (Alternative 1) Area: 58 Acres Protected

Species Name	Habitat Type	AAHU With	AAHU Without	AAHU Change
Shrimp	Tidal Marsh	33.07	19.14	+13.93
Clapper rail	Tidal Marsh	45.61	26.40	+19.21
			Total	+33.13

The other mitigation measure would have to be offsite and consists of wetland restoration or creation. Our compensation-HU analysis was based on tidal marsh creation (Table 7). With the erosion control, the amount of wetland creation required would be 134 acres. This mitigation cost is estimated to be about $60,258 per acre (Table 11). As such, the cost of marsh creation, coupled with erosion control credits, could be almost $8.1 million. If no erosion control is implemented, it would require 160 acres of marsh creation at a cost of about $9.7 million. In addition to these mitigation measures, the FWS would also be amenable to considering the reconstruction of the Grande Batture Islands as a mitigation method to compensate for part of the losses provided its design is satisfactory to the reviewing agencies and the environmental benefits in terms of marsh protection and oyster enhancement are assured.

Alternative 2

This design would require the filling of 61 acres of upland scrub/shrub, 72 acres of wet scrub/shrub, and 29 acres of tidal emergent wetlands.

The onsite and offsite mitigation measures that apply to Alternative 1 would also be applicable to this design. Some emergent marsh (29 acres) outside the dike would be filled with this alternative. As such the means to mitigate onsite with protection of the remaining 28 acres of marsh from eroding would be lessened by about 50% from that in Alternative 1. The shrimp HU gain credited for this mitigation was +6.72 (Table 9).

Table 9
Erosion Protection (Alternative 2) Area: 28 acres protected

Species Name	Habitat Type	AAHU With	AAHU Without	AAHU Change
Shrimp	Tidal Marsh	25.86	19.14	+6.72
Clapper rail	Tidal Marsh	35.70	26.40	+9.30
			Total	+16.02

This alternative also eliminates the filling of 14 acres of herbaceous wetland and 44 acres of scrub/shrub wetland inside the dike. The Corps had expressed a desire to attempt onsite mitigation by trying to improve these wetlands. The current fish and wildlife value of these wetlands is high and any attempt to get mitigation credit from improvements would be questionable.

Coupled with erosion control, the amount of marsh creation required to mitigate these losses would be 117 acres. This could cost about $7 million. If no erosion control is implemented, the amount of marsh creation required would be 130 acres at a cost of about $8 million. As with Alternative 1, the FWS would be amenable to considering the reconstruction of the Grande Batture Islands to serve at least as a partial mitigation measure for losses associated with this alternative.

Alternative 3

This design would require the filling of 61 acres of dry scrub/shrub, 127 acres of wet scrub/shrub, 5 acres of wet herbaceous, and 34 acres of tidal emergent wetland. The onsite and offsite measures described with Alternative 2 would also be applicable to this alternative. Only 24 acres of tidal marsh erosion protection would be provided since 34 of the 58 acres would be filled (Table 10).

Table 10
Erosion Protection (Alternative 3) Area: 24 acres protected

Species Name	Habitat Type	AAHU With	AAHU Without	AAHU Change
Shrimp	Tidal Marsh	24.94	19.14	+5.80
Clapper rail	Tidal Marsh	34.40	26.40	+8.00
			Total	+13.80

About 9 acres of wet herbaceous habitat would not be filled. For reasons provided with Alternative 2 (above), the FWS does not believe that onsite mitigation through manipulation of this habitat type would be justified. Even with erosion control, this design would require the creation of about 187 acres of marsh. The cost of this could be approximately $11 million. If no erosion control is implemented, the amount of mitigation acreage would be 197 acres at a cost of about $12 million.

Alternative 4

This design would cause the most damage to fish and wildlife resources. It would result in the filling of 61 acres of dry scrub/shrub, 127 acres of wet scrub/shrub, 14 acres of wet herbaceous wetland, and 58 acres of tidal emergent wetland. No onsite (erosion protection) mitigation would be available with this alternative, since all of the tidal marsh would be filled. About 213 acres of marsh creation would be required to mitigate these impacts. This creation project would cost about $13 million.

Mitigation Methods and Cost for Tenneco

The FWS, in conjunction with the Corps, has considered various mitigation alternatives which include: 1) restoration of altered wetlands; 2) creation of wetlands by shaving down low productive upland; 3) prevention of marsh erosion; and 4) creation of wetlands with dredged material (Grande Batture Islands). The following is a discussion of the methods, cost, and benefits of these mitigation measures.

1) Wetland Restoration

Restoration of altered wetlands is a preferred mitigation method since the potential for success is often greater than converting uplands to wetlands. As with creation, a problem is locating these mitigation sites. The cost and procedures for restoring wetlands will closely parallel that for creation of wetlands by excavating relatively low productive uplands. The cost of the land and removing the fill or grading down uplands are major expenses in both mitigation scenarios (Table 11).

2) Wetland Creation (Excavation of uplands)

This involves marsh creation from excavating relatively low productive upland areas and planting-cultivating marsh plants. A large part of project cost involved with this option is the purchase of acceptable sites. These sites have to be in areas of suitable hydrologic regimes such as near tidal creeks, rivers, or bays. Usually such areas have high real estate costs.

The area must be excavated to elevations suitable for the establishment of particular marsh types. The cost of this activity varies with the amount of excavated material. Once the area has proper elevations, it is then planted with native marsh plants. Often this is done by a professional

since performance standards are placed on these programs which require a certain degree of success. If the first attempt fails, planting must be tried again. Usually a survival rate of greater than 80% is required over a designated time frame. This cost involves the consultants fee, cost of plants, and preparation of area, actual planting operation, etc. Once the plants are in the ground, the FWS usually requires that periodic reports be submitted to provide information relative to the status of the vegetated area in terms of survival rate, condition of the plants, and wildlife utilization of the area.

In general, the major cost involves purchase and preparation of the site, planting, and reporting on the status of the project. In order to provide the Corps with some indication of this cost, we contacted various consultants providing marsh creation services. Three consultants and other individuals were interviewed for purposes of deriving an average cost figure for marsh creation. Table 11 shows the average cost of several major items involved with marsh creation programs. Naturally, the cost is subject to change in accordance with project location. However, we feel the figures provided here reflect current average values and can be used for projecting project costs for compensation.

Table 11. Cost of marsh creation program which involves shaving down low productive uplands

Actions	Cost of Action Per Acre	Other Cost*
Purchase of land**	$15,000.00	
Grading area down	$33,880.00	
Purchasing plants	$5,000.00	
Planting (labor)	$500.00	
Reports on mitigation		$600.00
Botanist time	$400.00	
Proposals, Secretary		$2,500.00
Project cost (subtotal)	54,780.00	
Maintenance (10% of project cost)	5,478.00	
Total	$60,258.00	$3,100.00

*Reports and secretarial time are costs that cannot be applied to a per acre basis but are shown to reflect overall mitigation expenditures.

**Average price of land near areas (waterfront) required for adequate marsh creation programs.

The manner in which each cost in Table 11 was derived is provided in itemized form as follows:

1. Purchase of land. This cost was provided by the Corps of Engineers for uplands adjoining the Bangs Lake marshes primarily extending to the west and north. Uplands real estate costs were estimated to be about $15,000.00 per acre. This is believed to be a conservative figure for purchase of such waterfront property required for adequate marsh creation.

2. Grading area down. This cost was computed on the average price of moving 1 cubic yard of material. On an average the excavation depth required for a mitigation site was estimated to be about 6 feet This amounts to 9,680 cys per acre. With an excavation cost of $3.50/cubic yard, the total

cost amounts to $33,880.00 per acre. (Personal contact with consultants).

3. Purchase of Plants. Cost of plants would be on an average of about $1.00 apiece (personal contact with consultants). Approximately 5,000 plants/acre would be needed if planted on 3 feet centers. This cost would, therefore, be $5,000.00 per acre.

4. Planting (labor cost). Based on interviews with consultants, it was estimated that one man could plant an acre of marsh in 50 hours. An average labor cost of $10.00 per hour was used. Thus, $500.00 per acre was computed for labor.

5. Reports. Reports on the mitigation would be required. This would describe the methods, plants, etc., employed and the success achieved from these efforts. A base figure of $600.00 was estimated.

6. Botanist time. Estimated through personal contact to be $400.00 per acre. This takes into consideration that supervision would require about 2 days per acre.

7. Proposals, secretary time. Based on an estimate from personal contact. $2500.00

8. Maintenance cost based on 10% of project cost. $5,538.00

3) Wetland Erosion Protection

Preventing marsh erosion is also being considered as a mitigation method. Tidal marshes in the Pt. Aux Chenes and Tenneco areas are experiencing severe erosion-caused losses. As such, if it is determined that without the project erosion would continue, then mitigation credit could be given for preventing or reducing the erosion process. The rate of erosion is critical in determining the acreage credit to be given. This information will be obtained through comparisons of aerial photos over different time frames. This mitigation method is considered in conjunction with the reconstruction of the Grande Batture Islands since the wave energy in the Pt. Aux Chenes Bay area will be buffered by the reestablished islands. Erosion prevention may also be implemented for the tidal marshes west and south of the old Tenneco dike through shoreline stabilization. For purposes of this draft report, it was assumed that the erosion rate of tidal marsh at the Tenneco area was about 1 acre per year. Before final mitigation plans can be agreed upon, the Corps should provide assurances to all appropriate agencies that this can be successfully accomplished. If such assurances cannot be made, then additional mitigative measures should be developed and implemented.

4) Grande Batture Islands Restoration

This alternative is also being considered as partial mitigation for the various Tenneco disposal designs. The amount of mitigation credited will depend on the acreage of habitat impacted and the environmental benefits to be derived from the specific restoration design.

Grande Batture Islands Mitigation

In view of the expected beneficial environmental effects of this alternative in terms of increased oyster production, erosion prevention, and marsh creation, no mitigation would be required for this disposal alternative (see Impact Section). The FWS is still concerned about the amount of fill involved with this alternative and means of buffering wave energy in Mississippi Sound to assure island stability. We recommend that the fill be limited to amounts that will adequately secure the island and provide environmental benefits. We strongly question the Corps proposed use of hay bales for buffering wave action. We strongly recommend that the Corps should consider use of other methods to contain and protect this material including such devices as Lanyard Tubes. These could be towed to the site and then submerged by filling with bottom material. This method has been successfully implemented on the east coast and should be given further consideration. We strongly believe that hay bales will not suffice as erosion protection measure on the south side of any placed dredged material. This technique may have some applicability on the north side of any placed material, facing Pt. Aux Chenes Bay.

As stated in the Impact Section, this alternative has a good potential to enhance fish and wildlife resources within the Pt. Aux Chenes Bay area. Our most recent estimates indicate that about 6.5 acres of marsh adjoining this waterbody are eroding each year. Reconstruction of the Grande Batture Islands could reduce this loss by 80%. Thus, about 5 acres of marsh could be saved annually. This is worth about an average of $148,519 per year in terms of fish and wildlife values over the project life (Appendix B). In addition, annual oyster production could be increased to 375 sacks/acre at $25.00/sack. In consideration that up to 4,200 acres of bottoms would be enhanced, the annual dollar benefit of this acreage would be about $39 million (Appendix A).

In view of these monetary benefits, we believe this alternative should be pursued. It not only could provide positive fish and wildlife features, but also eliminate the need of costly mitigation that would otherwise be

required if another alternative, like filling the Tenneco wetlands, is selected for implementation.

Round Island Mitigation

The renourishment of Round Island would result in the loss of some shallow water habitat. However, this barrier island provides unique wildlife habitat that will continue to be lost due to erosion without this project. As such, the FWS believes that, in this case, shallow water losses will be offset with the renourishment project and subsequent erosion abatement. Therefore, no mitigation would be required. However, the amount of material should be held to reasonable limits and the stability of this material should be such that it will remain over a time frame that will achieve the beneficial erosion protection expectations.

Since Round Island is a designated unit of the national Coastal Barrier Resources System, any construction on the island would likely necessitate consultation as required under provisions of the Coastal Barriers Resources Act (16 U.S.C. 3509). A more detailed explanation is specifically provided in the section on Coastal Barrier Resources Act.

Coastal Barrier Resources Act

In our September 1984 FWCAR, reference was made to Round Island in the Coastal Barrier Resources Section since it is the only designated coastal barrier within the project area. At that time no project actions were proposed for this area and, therefore, the FWS was of the opinion that no formal consultation under Section 6 of the Coastal Barrier Resources Act would be required. However, as now proposed, one disposal alternative would involve Round Island. As such, the Corps of Engineers must consult with the Department of the Interior prior to conducting any work that would affect this barrier island.

RECOMMENDATIONS

The FWS' position and recommendations on this project are provided in our September 1984 report. Since that report was completed, several new or modified disposal alternatives were formulated and are the major focus of this supplemental report. These alternatives are primarily for material removed from the Bayou Casotte channel and turning basin.

The following recommendations provide a general summarization of our previous views and comments and specific recommendations regarding the proposed Tenneco, Grande Batture Islands, and Round Island disposal alternatives.

1. The FWS continues to prefer and recommend that all dredged material be placed in upland or select gulf sites unless the intended use of such is for benefiting fish and wildlife resources (Grande Batture Islands or Round Island) as agreed to by the various reviewing agencies. The current maintenance dredging practice of open water disposal in the Sound should be discontinued and all material which cannot be placed in upland sites should be transported to deeper waters in the gulf.

2. If the Grande Batture Islands disposal alternative is not designed to the satisfaction of the FWS, then we recommend that Plan B (gulf disposal) with appropriate mitigation be the selected plan. This plan would eliminate shallow open water disposal, and the quantified impacts are minor. As stated in our 1984 report, only 7 acres of wetlands to be created by shaving down relatively low productive uplands would be required to replace fish and wildlife losses resulting from this plan.

3. Our 1984 report recommended mitigation for wetland impacts associated with dredging of the turning basin at Bayou Casotte. This and other general mitigation measures

described in that report will be required for the overall project.

The following recommendations are in regard to Tenneco, Grande Batture Islands, and Round Island disposal alternatives.

1. In view of the fish and wildlife losses, the intended industrial use of the Tenneco site, and mitigation cost, we recommend this alternative be eliminated from further study. However, if it should be pursued, the FWS recommends that adequate mitigation be incorporated as a part of this project and assurances of its success provided. Our preferred mitigation method would be to reconstruct the Grande Batture Islands. Such a plan would have to be environmentally sound and satisfactory to all state and federal natural resource management agencies. This restoration may only serve as partial mitigation for Tenneco impacts depending on the acreage of habitat losses, the degree of protection and expected environmental benefits of the specific Grande Batture Islands design. If the Grande Batture Islands concept cannot be implemented, then our second preferred mitigation would be wetland protection, restoration, or creation. The amount and cost of mitigation would vary depending on the Tenneco alternative selected. The following is the mitigation acreage requirement and subsequent cost of the various Tenneco alternatives assuming marsh restoration or creation only. If erosion control is included where applicable, then the mitigation requirement in terms of acreage would be reduced.

   Tenneco 1 - This alternative would require 160 acres of marsh creation at a cost of about $9.7 million.

Tenneco 2 - This alternative would require 130 acres of marsh creation at a cost of about $8 million.

Tenneco 3 - This alternative would require 197 acres of marsh creation at a cost of about $12 million.

Tenneco 4 - This alternative would require 213 acres of marsh creation at a cost of about $13 million.

2. As stated in our 1984 report, the FWS would be amenable to a scaled down version (from that considered by the Corps at that time) of the Grande Batture Islands alternative. We are of the opinion that this alternative could have beneficial fish and wildlife features in terms of reducing erosion of the Pt. Aux Chenes marshes and also enhancing oyster production. As such, the FWS recommends this alternative be further studied.

3. The Round Island disposal alternative would also result in the loss of waterbottoms. However, if the fill is held to reasonable amounts and the size of the island is limited to its historical dimensions, the prevention of erosion should offset shallow water losses.

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APPENDIX A

COST AND BENEFITS OF OYSTER REEF CREATION

OYSTER REEF CREATION
(Cost and Benefits)

The possibility of creating oyster reefs in association with the renourishment of the Grande Batture Islands has also been discussed. Cost factors would include such items as 1) price of shell for cultch, 2) transportation cost, 3) labor used for shell placement, 4) cost of seed oysters, and 5) maintenance of reefs. The cost estimates for these items were obtained from personnel of the Mississippi Bureau of Marine Resources, Gulf Coast Research Laboratory, Alabama Department of Conservation and Natural Resources (Marine Resources Division), and Louisiana Department of Wildlife and Fisheries. The following is an itemized list of the cost and benefits of planting oysters over a cultch free area. Prices have been updated from those contained in the 1984 report.

Cost and Benefits of Creating 1 Acre of Oyster Reef

Cultch material = \$13.00 cy^3 x 300 cys/acre = \$4,000.00[1].

Seed = \$1,000.00

Total - Reef = \$5,000.00 initial cost for 1 acre.

Maintenance Cost

Every 5 years about 1/5 acre of the 1-acre reef will need restoring (this will vary with climatic conditions).

Over 50 years will need to replace 1/5 acre 10 times or 2 acres of reef.

2-acre cost not assuming inflation is therefore \$10,000.00
Total cost of reef and O&M = \$15,000 over 50 years, or about \$300/year.

Benefits

1 acre of reef can be reasonably assumed to produce 500 sacks of oysters. Each sack is worth \$25.00 at 1989 prices[2]. 1 acre can produce \$12,500.00 per year.

\$12,500.00 = harvest value/year
300.00 = annual O&M cost

\$12,200.00 = net benefits of 1 acre of reef per yr. over 50-yr. project

Not assuming inflationary cost and benefits, the annual benefits could approach \$12,200.00 per acre.

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[1] Assumed cultch material purchase from Louisiana

[2] Obtained from Mississippi Bureau of Marine Resources

APPENDIX B

VALUE OF PT. AUX CHENES WETLANDS

WETLAND VALUES

The value of an acre of wetland habitat has often been debated and a wide range of economical benefits reported by various authors. Monetary values in terms of such features as fish and wildlife production, waste assimilation, and flood control benefits have ranged from $50,000 to $80,000 (Sea Grant, 1984).

Since some features of this project (Grande Batture Islands nourishment) could result in saving many acres of valuable wetlands, benefits may be attributed to the project. This could apply in cases where the Grande Batture Islands nourishment is enhancing and not mitigating the project. In cases where the marsh preservation is applied as mitigation, no benefits would be given. Any benefits resulting from this action could be applied to the benefit/cost ratio.

The FWS has estimated marsh values which are based strictly on tangible items such as hunting, fishing, and trapping activities. It should be realized that these figures do not represent the total value of wetlands for such features as water storage, filtration and flood control. In addition, many of the values are based on potential rather than actual occurrences. Much of our estimates were derived from similar marsh values obtained in Louisiana coastal wetlands (Dept. of Interior, June 1981).

The marsh values in this appendix were based on an estimated annual loss of 10 acres of marsh from erosion in the Pt. Aux Chenes area. It was predicted that the reconstruction of the Grande Batture Islands could reduce erosion by 80% and thus save about 8 acres of marsh each year over the 50-year project life beginning in 1991. Future erosion predictions may deviate from the estimated 10 acres from which these values are based. However, new values can be extrapolated from this base acreage. Over the 50-year project life, about 400 acres of marsh would be saved. However, since this is a gradual change (8 acres per year saved) Table 1), the values of this habitat were based on an average savings of marsh at the 25th year of the project life. At year 2016 this figure was 200 acres. Based on this acreage, the average annual value of this restoration in terms of fish and wildlife activities was about $237,631.00 per year.

Table 1
Acres of Brackish Marsh Within the Pt. Aux Chenes Area
With and Without the Grande Batture Islands Feature

Target Year	Acres of Marsh Without the Project	Acres of Marsh With the Project	Net Change
1990	2,220	2,200	0
1992[1]	2,190	2,198	+ 8
2000	2,110[2]	2,182[3]	+ 72
2010	2,010	2,162	+152
2020	1,910	2,142	+232
2030	1,810	2,122	+312
2040	1,710	2,102	+392
2041	1,700	2,100	+400
	Annual Average = 200 acres of marsh saved over 50 years		

[1]Project is in place.
[2]Without the project a loss of 10 acres would occur each year.
[3]with the project a loss of only 2 acres (80% reduction) is estimated per year.

Studies conducted by the FWS in Louisiana have estimated that similar marshes can support a sport finfish harvest of 41.4 lbs/acre, and a manday effort of 4.1 mandays/acre. Saltwater fishing surveys conducted by FWS in 1965 and 1985 reveal a dollar per manday increase of about $40 over this timeframe (1965 - $8.00 and 1985 - $47.00). Using this rate of inflation the dollar value at 1990 would be about $58.00 and $150.00/day by the year 2041. The average value of this increase, $100.00, was used to compute the manday value over the project life (Table 2).

Table 2
Sports Fishing Values in Terms of Mandays per Acre Over Project Life

Year	Acres of Marsh	Mandays (4.1/acre)	Manday value[1] ($100.00 per manday)
1990	0	0	
1992[2]	+ 8	32.8	$ 3,280.00
2000	+ 72	295.2	$29,520.00
2010	+152	623.2	$62,320.00
2020	+232	951.2	$95,120.00
2030	+312	1,279.2	$127,920.00
2040	+392	1,607.2	$160,720.00
2041	+400	1,640.0	$164,000.00
Annual Average =	200	820.0	$82,000.00

[1]$100.00 per manday (based on national fishing surveys of 1965 and 1985)
[2]Project is in place

Of the major commercial estuarine dependent commercial species (fishes, shrimp, and crabs), it was estimated that over 573 pounds were produced per acre. This figure was derived by applying 1963-1973 landing data (lbs) to total acres in the Louisiana study unit. A breakdown of lbs/acre taken from this study is provided in Table 3 with current ex-vessel prices[1]. This is used to obtain a dollar value per acre of marsh for commercial species.

Table 3
1988 Dollar Value of an Acre of Marsh for Commercial Fisheries

Species	Pounds/ Acre[1]	Ex-vessel price/lb.[2]	Value/Acre
Shrimp (inshore)	64.24	$2.87	$184.37
Shrimp (offshore)	30.00	$2.87	$ 86.10
Menhaden	457.12	$ .05	$ 22.85
Croaker	17.88	$ .30	$ 5.36
Blue Crab	.45	$ .35	$ .16
Spot	3.45	$ .20	$ .69
			$299.53/acre

[1] Taken from studies in similar marshes of Louisiana
[2] Ex-vessel price/lb. 1988 from NMFS, Pascagoula, MS

Table 4 shows the changes in acres and dollar values per acre over the project life. From 1983 to 1988 the dollar value per acre of marsh for several species of fish and shellfish increased from about $222.00 to $300.00. This increase of $80.00 over this 5-year period was used to project the increase in values over the project life. At year 2016, which is the 25th year of the project, the savings in marsh are expected to be about 200 acres. This, multiplied by the expected average increase in dollar values of commercial fish over the project life ($716.00 per acre), was about $143,200.00.

Table 4
Annual Commercial Fishery Benefits
of Saving 400 Acres of Marsh Over the Project Life

Year	Acres Saved	$/Acre	Total Dollars
1990	0	$300.00	0
1992	+ 8	$332.00	$ 2,656.00
2000	+ 72	$460.00	$33,120.00
2010	+152	$620.00	$94,240.00
2020	+232	$780.00	$180,960.00
2030	+312	$940.00	$293,280.00
2040	+392	$1,100.00	$431,200.00
2041	+400	$1,116.00	$446,400.00

Average Annual values = 200 acres x $716.00 = $143,200.00.

Hunting and Trapping

Potential hunting values for the Pt. Aux Chenes marsh is also based on similar manday use values obtained from marshes in Louisiana. As with sport and commercial fishing values, population trends within the Pascagoula area dictate that the demand for sport hunting and trapping would not decline over the project life. Hunting manday values were based on waterfowl, rabbit, snipe, and rail.

Tables 5 and 6 reveal the value of marsh for the various hunting activities. These dollar values are based on the expected average expenditures over the 50-year project life. Based on 1980 and 1985 surveys, waterfowl hunting increased from $15.00 to $26.00. Other small game activities increased from $11.00 to $14.00. Based on these values we estimate that the average dollar values for these outdoor activities over the project life will be $66.00 (waterfowl) and $29.00 (other game).

Table 5
Shows Potential Mandays/Acre and
$/Manday for Hunting Activities in Brackish Marsh
Over Project Life

Habitat	Hunting Activity	Potential Mandays/acre	$/Manday
Brackish marsh	Waterfowl	.383	$66.00
	Rabbit	.120	$29.00
	Rails	.188	$29.00
	Snipe	.188	$29.00

Table 6
Value of Saving an Average Annual 200 Acres
of Marsh over the project life for Various Hunting Activities

Hunting Activity	Potential MD/acre	$/MD[1]	Average Annual Acres	Potential[2] Annual MDs	Average[3] Values
Waterfowl	.383	$66.00	200	77	$5,082.00
Rabbit	.120	$29.00	200	24	$ 696.00
Rail	.188	$29.00	200	38	$1,102.00
Snipe	.188	$29.00	200	38	$1,102.00
Non-consumptive	.60	$29.00	200	120	3,480.00
					$11,462.00

[1] Obtained by comparing 1965 and 1985 manday values in the national hunting surveys.
[2] Mandays derived by multiplying the potential manday/acre figure by the average acres saved over the project life.
[3] Average project life values derived by multiplying the $/manday by the annual mandays.

Trapping

Values for potential fur trapping were obtained by taking an average of fur prices for furbearers common to brackish marshes. These were muskrat, otter, raccoon, nutria, and mink. The values of the pelts were averaged and this average was applied to the average fur animal harvest per acre as obtained from Louisiana marsh studies. Table 7 shows the value of an acre of marsh in terms of fur production.

Table 7
Dollar Value Per Acre of Marsh for Fur Trapping

Avg. Fur Animal/acre	Average Acres	Total Animal Harvest/year	$ Value/Pelt[1] Average Price	Annual Value
$.50	200	102	$9.50	$969.00

1983 prices provided by MDWC. Fur price per dry pelt: muskrat, $2.50; otter, $15.00; raccoon, $10.00; nutria, $1.00; mink, $19.00. Avg. price = $9.50/pelt.

The annual fish and wildlife benefits for saving an average of 200 acres of the Pt. Aux Chenes marshes over the project life are provided in Table 8.

Table 8
Annual Average Dollar Value of Saving an Average
200 Acres of Marsh Over the Project Life

Activity	
Sports fishing	$82,000.00
Commercial fishery	$143,200.00
Sports hunting and non-consumptive rec.	$11,462.00
Trapping	$ 969.00
Annual Value =	$237,631.00

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